

# THE REPTILES OF CHINA

美國博物館

中亞調查記

۱۰. *وَأَمَّا الْفُلُ فَأُرْسِلَتْ بِإِذْنِ رَبِّهِمْ* فَاصْبِرْ لِحُكْمِ رَبِّكَ  
 وَأَلْقِ مَا فِي الْبَطْنِ لِيْ يَخْرُجَ بِكَ وَالْمَوْجُدُ يُدَمِّرُ الْأَنْجَارَ

# CENTRAL ASIATIC EXPEDITIONS

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# THE REPTILES OF CHINA



CENTRAL ASIATIC EXPEDITIONS

ROY CHAPMAN ANDREWS, *Leader*

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THE REPTILES OF CHINA

TURTLES, CROCODILIANS, SNAKES, LIZARDS

BY

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*With 78 Illustrations in the Text, including a Map,  
and 27 Plates at end*

NATURAL HISTORY OF CENTRAL ASIA

VOL. X

CHESTER A. REEDS, Ph.D., Editor

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THE AMERICAN MUSEUM OF NATURAL HISTORY

FREDERICK TRUBEE DAVISON, *President*

NEW YORK

1935

**THE REPTILES OF CHINA**

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The American Museum of Natural History

Published May 11, 1935

First Edition

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7723

OCT 22 1954

59.81(51)

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## PREFACE

THE foundations of this work were laid in 1921 when I went to China as a member of the Central Asiatic Expeditions of The American Museum of Natural History led by Roy Chapman Andrews. Although it was originally planned for me to act as general assistant to Doctor Andrews, it soon became evident that there was nothing to hinder my working alone and independently as a collector of reptiles, amphibians, fishes and mammals. With a special fondness for reptiles and an ever increasing interest in amphibians, I naturally spent most of my time and energy in the field of herpetology. Other members of the expedition also secured reptiles and amphibians and thus a very large number was brought together. As soon as good series of specimens reached New York, Mr. Karl P. Schmidt began to study them and continued to do so until he had reported on approximately half of the entire collection in three main papers, all of which were published in 1927 (see Bibliography). After the completion of my field work in 1926 and my final return to New York, Mr. Schmidt ceased to study the material, and turned it over to me for further investigation. It is largely due to the extremely thorough and conscientious beginning made by Mr. Schmidt that I was enabled to pursue the work, bringing it to completion in two papers, one published in 1929, the other in 1931. These reports by Mr. Schmidt and myself are of a strictly preliminary nature and include only the species actually collected by the expedition, while the present work is a comprehensive and critical treatment of all the known snakes, chelonians, and crocodilians of China, together with an annotated check list of the lizards. The original intention was to include the entire herpetological fauna in one volume, but this proved to be impossible.

During the preparation of this work many persons and institutions have rendered invaluable aid, without which my task could not have been accomplished.

I have had at my disposal the collections of the British Museum (Natural History), London; the Museum of Comparative Zoölogy, Cambridge, Mass.; the United States National Museum, Washington; the Muséum d'Histoire Naturelle, Paris; the Naturhistorisches Museum, Vienna; the Senckenbergisches Museum, Frankfurt-am-Main; and the Naturhistorisches Museum,

Berlin. To the authorities of these institutions I am deeply indebted and wish to express my sincere thanks.

To Director C. Tate Regan, Doctor William Thomas Calman, and Mr. H. W. Parker of the British Museum; Director Thomas Barbour, Messrs. Arthur Loveridge and Benjamin Shreve of the Museum of Comparative Zoölogy; Doctors Leonhard Stejneger and Doris M. Cochran of the United States National Museum; Doctors Louis Roule and F. Angel of the Muséum d'Histoire Naturelle; Doctor Otto Wettstein of the Naturhistorisches Museum, Vienna; Doctor Robert Mertens of the Senckenbergisches Museum; and Doctor Ernst Ahl of the Naturhistorisches Museum, Berlin, I am grateful for many courtesies and much assistance while working at their respective institutions.

While studying at the British Museum, I not only received much valuable advice from Doctor Malcolm Smith but was given access to his personal collection, and for this help I now express my appreciation.

Doctor Baini Prashad has kindly supplied me with data as well as loaned me material from the Indian Museum, Calcutta, and Mr. Joseph R. Slevin has loaned me material in the California Academy of Sciences. I am grateful to these scientists for their help.

My thanks are due to the following colleagues living in China who have supplied useful data or sent me valuable material as gift or loan: Doctor Alice M. Boring of Peiping, Doctor C. C. Liu of Soochow, Mr. Arthur de Carle Sowerby of Shanghai, Mr. Sidney D. Hsiao of Wuchang, and Mr. Mangven L. Y. Chang of Nanking.

Doctor Emmett Reid Dunn of Haverford and Doctor Jean Roux of the Naturhistorisches Museum, Basel, have examined material for me, and for their service I am thankful.

Indispensable assistance in the solution of nomenclatorial problems presented by geographical names as well as in the allocation of obscure localities, has been given by Doctor Vladimir P. de Smitt of New York, Doctor R. Mell of Berlin, Reverend David C. Graham of Chengtu, China, and Colonel Frank Wall of England. Doctor Mell also extended many courtesies to me during my visit to Berlin. It is a pleasure to acknowledge obligations for these favors.

From the beginning, my wife, Sarah H. Pope, has not only taken a great interest in this work, but from time to time has very materially helped in its preparation by examination of specimens, cataloguing of literature, and reading of completed manuscript. For this affectionate assistance as well as ceaseless encouragement I shall be forever grateful.

Mr. Charles W. Dawson of Virginia served as a full-time assistant for an entire year. To him I express great appreciation for conscientious work ranging from the counting of scales to excellent typing of manuscript.



Mr. Harry Davis of New York has read the entire manuscript, made a preliminary draft of the index, and helped in innumerable other ways for many months, and to him I am greatly indebted.

Messrs. John T. Nichols, John T. Zimmer, George H. H. Tate, Doctors Walter Granger, James P. Chapin, and E. W. Gudger, all of the Scientific Staff of the American Museum, have been most generous in giving advice whenever requested, and for their aid I am especially appreciative.

It has been necessary throughout the preparation of this volume to look up many obscure bibliographic references. For cheerful and tireless help in so doing I am truly thankful to Miss Hazel Gay and her staff of efficient librarians.

Miss Alma W. Froderstrom of New York, Doctor Doris M. Cochran of Washington, and Mr. Charles W. Dawson have supplied excellent drawings which are reproduced as text figures, while Mr. Hugh S. Rice of the American Museum has skilfully photographed numerous published illustrations, some of which appear as plates, others as text figures.

The folding Map and Table are demonstrations of the beautiful lettering done by Mr. Frank S. Vitolo of the American Museum.

Mr. Shoichi Ichikawa, also of the American Museum, has willingly rendered much-needed assistance in translations of Japanese text.

Obviously, none of the work that has produced this volume could have been accomplished without the facilities offered by the American Museum and the support of its former President, Henry Fairfield Osborn, and Director, George H. Sherwood. I hereby acknowledge my deep appreciation to Professor Osborn and Doctor Sherwood for the privilege of working under such superb conditions. Also I am fully mindful of the generosity of Doctor G. Kingsley Noble in relieving me for so long a time of my usual duties as Assistant Curator in the Department of Herpetology and thus allowing me to devote all my efforts to the completion of this volume.

The volume has been edited by Doctor Chester A. Reeds with the assistance of Miss Clara M. Beale and Mr. Edward A. Skinner.

Finally, I am obligated to Doctor Roy Chapman Andrews for three rare opportunities: that of serving for four years as Assistant on the Central Asiatic Expeditions; of seven months' research in European as well as in American museums; and of writing "The Reptiles of China." I can only regret my inability to express adequately through words my feeling of sincere gratitude to Doctor Andrews.

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## PART I

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# CHAPTER I

## HERPETOLOGICAL COLLECTING IN CHINA

### INTRODUCTION

NUMEROUS scattered references to the herpetology of China are to be found in the literature of the first half of the nineteenth century. During that period material was usually labeled "China" without further details. Due to the scanty knowledge of geography current in those early times, few people had any conception of the vastness of the empire then ruled by the decadent Manchus. Matters continued thus until the appearance in 1864 of Guenther's monumental work "The Reptiles of British India," which dealt not only with India, but China, Indo-China and Siam as well. In writing of the fauna of China, Guenther stated (p. ix) that "we can hardly look forward to very numerous additions to our list of species, except perhaps from the western and south-western provinces." As a matter of fact, most of the snakes included in the following pages have been described since 1864. It must be admitted, however, that had Guenther confined his statement to turtles it would have been justifiable. Even now there is little doubt that many ophidian species will yet be added to the Chinese faunal list. The period from 1864 to 1888 saw little increase in our knowledge of Chinese herpetology, and yet no attempt to summarize this knowledge has been made since the latter date. Obviously, then, the vast majority of new data that have accumulated since 1864 remain to be brought together as well as correlated.

Such bringing together and correlating of so many data are seldom undertaken without a special stimulus from some definite focal center. The focal center in the present case is The American Museum of Natural History; the special stimulus, the Chinese collections made by its Central Asiatic Expeditions.

### CENTRAL ASIATIC EXPEDITIONS

The Central Asiatic Expeditions were first conceived by their leader, Roy Chapman Andrews, as early as 1912. Three years later a definite plan of exploration was presented by Doctor Andrews to Henry Fairfield Osborn, then President of The American Museum of Natural History. The First

Asiatic Expedition was actually led into southern and western China and northern Burma during 1916 and 1917. It was then that the initial part of the enormous reptile collection forming the basis of this volume was secured. The herpetological material brought back by this initial effort did not include large series of individual forms, but contained, nevertheless, many rare species such as the pit-viper, *Agkistrodon monticola*, and the agamid lizard, *Japalura yunnanensis*. This work in southern China inspired Doctor Andrews with the idea that systematic exploration in so vast a continent as Asia required the efforts of more than one or two scientists. Therefore, after making preliminary surveys of Mongolia during the summer of 1919, known as the Second Asiatic Expedition, Doctor Andrews returned to New York with the basic plans for the organization of a vast attempt to unravel at least some of the many fascinating problems presented by the high plateau of central Asia, this attempt to be known as the Third Asiatic Expedition.

A man of lesser breadth of view might have aspired to investigate only a few aspects of the geological and zoological problems of Asia, but Doctor Andrews was not satisfied until his plans included thorough study of Asiatic geology, topography, palæontology, botany and vertebrate zoology. As stated by him, "*correlated work* was to be the basis of the scientific organization."

#### COLLECTING IN VARIOUS PROVINCES

##### Hopei

The field work of the Third Asiatic Expedition really began in Peiping on April 14, 1921, the date of Doctor Andrews' arrival there. He was followed on June twenty-eighth by Walter Granger and myself. Plans for actual collecting were soon completed, and on July twenty-seventh Doctor Andrews and I set out for the Tungling region, where I was to learn as much Chinese as possible as well as receive training in the methods of collecting in China.

The Tungling or Eastern Tombs region lies only a short distance to the northeast of Peiping. At the time of our work there, a forest remnant still harbored many interesting animals exceedingly rare or completely extinct in the adjacent parts of northeastern China. Although no reptile of the Tungling region is actually extinct elsewhere, some species, such as the large and handsome snake, *Elaphe schrenckii anomala*, and the skink, *Eumeces xanthi*, still abundant there, are not readily secured in the surrounding deforested parts of China.

We first camped in the forested mountains above the area already devastated by the avid lumbermen who were working in the lower valleys. Incessant rains and almost total lack of a local population made collecting next to impossible. On August fifth, we moved down to Hsinglungshan, a busy lumber mart situated in a wide, cultivated valley. Here it was not difficult to arouse



interest in collecting and we soon secured large series of all the common species. After a few days of successful work we again moved to a lower, even more open site some twenty-six miles below Hsinglungshan, where substantial additions to our already valuable collection were made. From this camp site we went out of the mountains and back to Peiping, securing en route on August fourteenth and fifteenth at Kichowpeh a large series of the interesting brevicipitid toad, *Kaloula borealis*. These toads were breeding in great numbers in the quiet water of ditches within the walls of the ancient town.

While this trip to the Tungling region had afforded only a few days of good field work, it had taught me something of the art of collecting in China. I say "art" because, in this land of ancient culture, where human relations are of such great consequence, the usual methods do not suffice and experience alone can teach one how to obtain the best results. In about three weeks I had gained some insight into oriental psychology and methods of dealing with rural Chinese which proved extremely helpful in my work in other parts of China. Satisfactory relations with the local farmers must always be established, especially whenever they are asked to do much of the actual catching of specimens. In approaching a farmer for information, one should not make abrupt, specific inquiries, because the oriental farmer, for all his rugged appearance, is in some ways a polished gentleman whose mind must be tactfully directed toward the desired subject. I found it also necessary to learn how to bargain, since in petty trading the oriental invariably asks a price far higher than the one he expects to receive.

### Anhwei

Although it had been originally planned that during the remaining months of 1921 I should accompany Doctor Andrews on his trips into various parts of northern China, it became evident after my return from the Tungling region that there was nothing to prevent my launching out to more southern provinces on my own account. Therefore, September eighth found me bound for Ningkwo, an Anhwei city situated south of the Yangtze. Debarking from a river steamer at Wuhu, I rented a houseboat before proceeding to Ningkwo. This boat served as a base during the month spent in the region of Ningkwo, where the local population proved to include excellent collectors. Here I taught my assistant the "inside" work of collecting so that I could be relieved of such routine and spend much of my time searching for reptiles and amphibians and making observations on life histories. Here also I adopted the plan of buying only specimens in perfect or almost perfect condition. Experience soon showed me that practical people get results with the least possible effort and if mutilated specimens are bought, mutilated specimens will be brought in; but if only perfect specimens are bought, then only such will be

brought in. Is it not safer to kill beyond question a snake or lizard before attempting to handle and transport it?

One of the most interesting results of the work at Ningkwo was the discovery of a new snake of the genus *Elaphe*, later named *Elaphe bimaculata* by Schmidt. This species had been collected before, but never recognized as distinct from *Elaphe dione*, one of the commonest snakes of northern China. From the point of view of behavior, the secretive "two-headed snake," *Calamaria septentrionalis*, is the most fascinating reptile found about Ningkwo. The head and tail of this species are remarkably alike in both form and color. A captive specimen, when held by the tail, continued to try to escape. When its head was pinned down the whole body was instantly thrown forward, wrapped around the restraining fingers, and the tip of the tail repeatedly pressed against them. The tail apparently takes the offensive while the head tries to escape. The tail, in short, not only mimics the head in form and color pattern, but in behavior as well.

#### Szechwan

About the time of our departure for Ningkwo, Walter Granger had left Peiping for Wanhsien, near which he spent the fall and winter collecting fossils and recent vertebrates. Most of the herpetological material secured by him came from two localities: Yenchingkou, which is reached by going about ten miles up the Yangtze from Wanhsien and then about the same distance inland from the south bank; and Luanshihkou, located some twenty miles north of Wanhsien. Granger not only spent the winter of 1921-1922 in the Wanhsien region, but returned twice thereafter. The reptiles secured by him there were the only ones collected in Szechwan by the Central Asiatic Expeditions. His collection includes one of the three known specimens of *Amblycephalus boulengeri*, a snake originally described from Kweichow by Angel. Although strictly speaking, Walter Granger is a palæontologist, nevertheless he has a keen interest in recent vertebrates and supplemented the herpetological collection by material secured in Yunnan and Mongolia, as well as by his Szechwan finds. In Yunnan he discovered two snakes, *Bungarus multicinctus wanghaotingi*, a form of the common Chinese krait, and *Amblycephalus niger*, a new species of another family, the Amblycephalidæ.

#### Hunan and Anhwei

After returning to Peiping from the Ningkwo region, I proceeded to the Tungting Lake in northeastern Hunan. Winter had set in by the time of my arrival there, and few if any reptiles and amphibians were abroad. Only a small herpetological collection was secured before my departure for Wuhu in March. The purpose of this second visit to Wuhu was to secure specimens of

the Chinese alligator, *Alligator sinensis*, known to science since 1879 but still rare in collections. On my 1921 trip through Wuhu, I had found no trace of alligators. The region was then inundated and the local fishermen had assured me that during flood times it is extremely difficult, if not impossible, to secure specimens. Upon my arrival in March, conditions were generally favorable, so I wasted no time in sending out a scouting expedition. After a few days, messages began to come in; my collector had located alligators at a point about seven miles above Wuhu on the banks of the Chingshui River, a stream entering the Yangtze from the south at Wuhu. For some time, reports as to the price per alligator improved, for I had wisely kept in the dark, knowing full well that the untimely arrival of a foreigner would send the price skyward. Finally, on the nineteenth of March, my collector arrived, striding proudly behind a rickshaw loaded down with five securely bound alligators. My joy knew no bounds and I was soon on my way to the scene of action. It was disappointing to learn that the specimens had been dug out while still hibernating in holes in the treeless river plain and were as yet quite inactive. My collector added life to the scene by graphically illustrating how he, with the local hunters, had chased down and captured barehanded a wildcat which had concealed itself in one of the alligator holes. Not only was this association of cat and alligator interesting, but also the fact that the barrenness of the surrounding plain had not afforded a suitable place for even a cat to hide.

One cannot help wondering at the remarkable survival of *Alligator sinensis* in the midst of a region so densely populated, and this in spite of the fact that there is some commercial value attached to it. The ease with which hibernating individuals are dug up makes this survival even more puzzling. The only possible explanation lies in the assumption that they were once widely distributed and extremely abundant in the delta regions of eastern China.

### Suiyuan

On April 18, 1922, I set out for Suiyuan to the northwest of Peiping. I had hoped on this trip to reach Ningsia, but the unsettled political conditions forced me to be satisfied with working over the region from Kweihwa to Paotowchen. Most of the collecting of this trip was done at Maitaichao, which is located some thirteen miles east of Saratsi. The herpetological fauna of Suiyuan is anything but rich, so we were able to secure only a few species in the region worked. The fauna is essentially the same as that of northern central Asia, and the data obtained were chiefly of importance in helping to determine the extent to which this northern element penetrates China.

### Shansi

After completing the work in Suiyuan, I returned to Peiping and prepared

to collect in central Shansi. By July eighth headquarters had been established about sixteen miles south of Taiyuan at Chintzu. From this locality we secured material as far north as Ningwu. Lizards and snakes proved to be abundant and consequently large series of the few species were preserved. The fish fauna was of great interest as shown by the fact that ten of the twenty-eight forms collected have been described by Mr. John T. Nichols as new to science. On my way back to our Peiping headquarters I briefly visited the villages of Sohuang, near Pingting, and Niangtzekwan, on the eastern boundary of Shansi.

By this time, experience had taught me the inestimable value of even a slight knowledge of spoken Chinese, and I therefore continued to devote as much time as possible to its study. In fact, from the start, I had fully intended to visit every province of China and considered time spent on the language as an investment to be drawn upon in the future. Contrary to general belief, the Chinese dialects do not present an insurmountable hardship to the foreigner, because the really difficult ones are confined to a very narrow strip of coast extending from Shanghai to Canton, a region of relatively small importance to collectors. My right to generalize is based on experience in seven provinces, ranging from Suiyuan in the north to the interior of Hainan in the extreme south, and as far west as Hunan and Shansi. These facts are recorded for the use of future workers, who, doubtless, upon arrival in China, will be solemnly informed that it is folly to attempt to learn Chinese for practical purposes. I shall never regret having completely disregarded all such advice.

### **Hainan**

Although Swinhoe, Whitehead and other early explorers collected reptiles and amphibians on Hainan, the herpetological fauna of that remote island was not well known even as late as 1922, when it was decided that I should visit it to make an extensive collection of reptiles, amphibians, fishes and mammals.

Soon after arriving on Hainan, I decided to make Nodoa my headquarters. This town is located in the hilly country intermediate between the island's northern plain and its southern mountains. Ample quarters were turned over to me by the late Rev. William J. Leverett and other members of the American Presbyterian Mission at Nodoa, and throughout my sojourn there, from the middle of November, 1922, to early August, 1923, every courtesy was shown me by these kind people.

Through the cooler winter months most of my time was spent studying and collecting mammals, but before the end of February, hot weather set in and reptiles rapidly became abundant. Surrounded by a far richer fauna than that of any part of northern or central China already visited, I found it

necessary to organize more thoroughly local helpers. Anyone who has collected in the tropics is fully aware of the fact that no single individual can hope to secure even a small part of the fauna single-handed. I, therefore, not only hired a fisherman and taught him to catch amphibians, but also employed other individuals who showed any aptitude for collecting. In addition to this, my interpreter of local dialects, Ah-Sen, advertised by word of mouth among all the outlying villages. Before long a steady stream of specimens was flowing into my injecting room and I was able to devote most of my time to field studies of amphibian life histories, a subject in which I was especially interested at that time.

While my work was progressing at and near Nodda, Dr. Malcolm Smith, now of the British Museum, visited the Kachek region and penetrated into the wilder mountains of southern Hainan. Doctor Smith brought together a rich collection during his short visit and has reported on his reptiles and amphibians in detail (1923, pp. 195-212) as well as written an excellent narrative of his journey (1923, pp. 185-194).

Needless to say, my collection grew rapidly. It finally included more than one hundred species of reptiles, amphibians and fishes. The fish collection especially turned out to contain a remarkable number of novelties, about one third of the forms now known from Hainan having been based on this material. The reptiles alone numbered about 1600, among which nearly fifty forms were represented. Fifteen of these had never before been recorded from Hainan. The turtles alone added five species to Hainan's faunal list. The acquisition of this collection stands as another milestone toward the perfect knowledge of the herpetological fauna of southern China. It contains invaluable material for comparison with that of the likewise rich collections made in Kwangtung by R. Mell and in Kwangsi by Sun Yatsen University of Canton. A comparison of these three collections has brought our knowledge of the herpetology of southern China to a point comparable to that of any other region of the earth in the same latitude.

#### **Fukien and Kiangsi**

After discussing with Karl P. Schmidt the relative importance of various parts of China for a continued study of its herpetological fauna, we decided that I should make an intensive survey of the valley of the Min River in Fukien. Therefore, upon my return to China from the United States in 1925, I proceeded at once to Foochow. This time I had the experience of two and a half years' work in six more northern provinces to base judgment upon and, of course, felt infinitely more confident than ever before.

Knowing from the experience of others that Yenping is an ideal base from which to work, I proceeded at once to that city, arriving April eleventh. The

city stands at approximately five hundred feet above sea-level, while the mountains immediately behind it rise to about 4000 feet and are forested in their more remote parts. I made actual headquarters in Hsiyuankeng, the deep and wild gorge just above Yenping, where a conveniently situated temple affords shelter from wind and rain. Although well located and surrounded by ideal habitats for all kinds of animal life, the extreme steepness of the gorge and incessant rains rendered work difficult. The small size of the only nearby village eliminated the possibility of collecting by means of arousing the local populace. It was consequently impossible to secure large series of many of the less common species. The few villagers with time to spare showed, nevertheless, great interest in helping me and, as the weather cleared, my work improved considerably. After spending the remaining weeks of April and all of May in the Yenping region, where nearly sixty forms of reptilian and amphibian life as well as numerous mammals and fishes had been brought together, I decided to proceed up the Min.

I left Yenping by boat June fifth and arrived at Chungan City the eleventh. From there I went at once to Hsingtsun, one of the famous tea markets of the Bohea Hills. It seemed impossible to interest the local farmers of the Hsingtsun region in collecting, so, on June twentieth, I set out by foot for my final objective, Kuatun. This collecting site is situated in the high mountains separating northwestern Fukien from northeastern Kiangsi. It was first made known to science by Abbé Armand David, who visited it in 1873 and secured so much interesting material that Mr. J. D. La Touche went there in 1896 and again in 1898. His collections in turn contained a sufficient number of novelties to show that this veritable mine had by no means been exhausted by David. For a few years after 1898, members of the T'ang family of Foochow continued the work begun by David and La Touche so that Kuatun soon became the common type locality of innumerable species of animals.

At 2:00 P.M. of my second day's walk from Hsingtsun, I reached Sanchiang, a village at the base of the mountain upon which Kuatun is located and a long hour's climb from Kuatun itself. The villagers gave me a hearty welcome and, in strong contrast to the population of Hsingtsun, seemed to be anxious to collect. Unsettled times had for years prevented the T'angs from visiting the region, but surprisingly enough, many of the people recalled the collecting of former years and some even remembered La Touche's visits of 1896 and 1898.

Although deforestation is in progress in the open valleys about Sanchiang, the slopes of the higher mountains of the vicinity are still forested, and it is probable that not enough damage has been done to affect the reptile and amphibian life of the region. Kuatun itself is little more than a series of houses

widely scattered through an elevated valley, bowl-shaped at its upper end and terminating high on one flank of Kuatun Mountain. For a livelihood, the industrious inhabitants hunt, cultivate tea, dry bamboo shoots and prepare bamboo fiber. The fiber and dried shoots are sold in distant market towns of more thickly populated regions.

Early on the morning after our arrival, a boy voluntarily appeared with a snake tied to a stick. Obviously, interest in collecting had been aroused, and from that moment on specimens were brought in as fast as could have been wished. Seven days in the week found me, as well as my several assistants, busy from daylight to long after dark and even well on into the night. Although I slept at Sanchiang, the Kuatunites made regular visits to bring specimens, while I in turn frequently spent the day collecting in the Kuatun valley.

About the middle of July, a slight infection of my foot grew worse and, because of it as well as a desire to work in the general region of Foochow before winter, I decided to return to the coast. On the way down, a brief halt at Yenping allowed Chen Da-Da, my chief collector, to secure more specimens from Hsiyuankeng.

After spending a few days at Foochow and Kuliang, I proceeded to Futsing Hsien, which lies on the coast immediately southeast of Foochow. This district, with its low, level plains, is nearly everywhere well populated. The few rugged mountains that intersect the plains are covered with grass, scrub evergreens and dense thickets. Headquarters were established at Lingshihszu, a monastery lying within a bowl-shaped valley encircled by the most unspoiled mountains of Futsing Hsien.

The few villagers of the Lingshihszu valley proved to be willing helpers and our collection grew rapidly. In fact, the number of species secured here and at Foochow falls little short of the total for Yenping, and this in spite of the relatively wild condition of the Yenping mountains. An explanation of the wealth of the Futsing Hsien fauna lies partly in the presence there of tropical forms unknown at Yenping. Toward the end of September, work with the amphibians and reptiles of Futsing Hsien was brought to a close. The weather had grown much cooler and specimens had become increasingly difficult to secure. On October fifth, headquarters were moved out of the Lingshihszu valley, and from then on until early spring of 1926 my time was devoted to mammal collecting.

During the hunting of the winter I had determined to return to the Sanchiang-Kuatun region and complete my collections from there. The brief visit of the previous summer had convinced me that the surface had barely been scratched. Consequently, April 24, 1926, found me once more at Sanchiang. My former helpers greeted me with open arms and promised to collect more vigorously than ever before. My visit of the previous year had

made me quite familiar with the surrounding ranges, and this time I was able to work alone and without a guide. My chief interest still centered in amphibian life histories, so of course most of my time was spent in the forests and streams. The excellent team of assistants with me was so well trained that they took almost entire charge of the indoor part of the work and thus I was left free to devote nearly all of my efforts to actual field observations.

I had originally planned to go into Kiangsi from Sanchiang and investigate the eastern part of that province, but, as time slipped by, there was more and more to do, so I finally decided to send Chen Da-Da on a brief visit to Hokow. The small but rich fish collection secured on this trip proved to be of special value, containing as it did no fewer than six new forms, all of which have been duly described by Mr. Nichols. The reptiles and amphibians, although representing known species, have been of considerable interest for purposes of comparison.

At the end of five months spent at Kuatun and Sanchiang, I received word from Doctor Andrews that the time for my return to the United States had arrived. On September 4, 1926, I left the region with deep regret. Without doubt, my most successful work had been accomplished here where, also, the local populace had been by far the most coöperative of any it has been my good fortune to be among either in China or America.

A prolonged study of the Sanchiang-Kuatun collections has proved that no mistake was made in the choice of a region to work intensively. A brief summary will suffice to show the richness of the herpetological fauna secured there. In number of forms the snakes come first, with a total of thirty-five, and frogs second, with twenty-four. No fewer than six of the snakes proved to be new to science. The lizards are far behind with only nine, but these represent six families, so there is sufficient variety in this group to make up for lack in numbers. Turtles, oddly enough, are totally absent, while the two salamanders testify to the scarcity of this group also. Making allowances for a few species that undoubtedly escaped us and still others that might accidentally reach the region, it may be safely concluded that fully eighty forms of reptile and amphibian life occur about Sanchiang and Kuatun at altitudes ranging from approximately 3000 to 5500 feet.



## CHAPTER II

### METHOD FOLLOWED IN SYSTEMATIC ACCOUNT

#### GENERAL STATEMENT

THE method of treatment of each form included in Part II does not follow any existing pattern known to me but has been worked out in such a way as to place equal emphasis on various aspects of herpetology, such as description, distribution, ecology and synonymy. In the past, far too much emphasis has been placed on description and synonymy at the expense of ecology. While it must be admitted that the ecology included here is of a rather primitive kind, nevertheless, it is the best available and must suffice for the present. Special effort has been made to completely document Part II. The object of this is to allow students to refer back to original sources and thus check the accuracy of all borrowed statements. In this respect I believe the present work to be unusual since far too many general faunal monographs make blanket statements which can never be traced to their original sources.

Each form is dealt with under a maximum of six headings, the treatment under every heading being standardized as explained below.

#### Synonymy

Complete synonymies are seldom given, but all names of forms actually based on Chinese material are included. Generic synonymies are even more abbreviated, but the most pertinent generic names will be found in either the generic or the specific synonymies. Strict chronological sequence is followed and every new combination of names set off as a separate paragraph. Great care has been taken in spelling, but in a few cases specific names differing only in the presence of a single or double final "i" have been included in the same paragraph. Incorrect names based on misidentifications have been placed in the synonymies of the species that the original material actually represents, but not, however, without the customary indication.

In every reference, the date of publication immediately follows the author's name. Whenever a second and different date is involved it is placed after the name of the publication.

### Description

As a rule, each species is first diagnosed by a concise and fully standardized description based on the best series available. Following this, additional data are given illustrating the ranges of geographical variation, size attained and any other points of special interest. Sexual dimorphism is considered next, and this in turn is followed by the original description or a translation of it. A detailed description of the hemipenis closes the section. Various deviations from this plan are often unavoidable, due to lack of data, the difficulty of securing certain specimens for examination, etc. Some original descriptions have been omitted because of their extreme brevity, but in such cases the standardized descriptions have been correspondingly amplified. The color pattern is described either in the original or in the standardized description.

Considerable care has been exercised in counting the maxillary teeth. The figure given always represents the full complement of teeth and not just the number that happen to be in place at the time of examination. These true counts can be obtained only by a painstaking search for empty sockets in the tooth-bearing edge of the maxillary bone.

Every description of a hemipenis represents a ventral view of one of these organs lying in its normal position in the tail. The aspect described can best be obtained by cutting the hemipenis longitudinally down the side opposite the sulcus. The line on which the cut is made generally extends along the lower, inner surface of the organ, i.e., the ventral part of the surface lying adjacent to the other hemipenis. Of course the full normal extension or point of termination cannot be accurately determined if the organ is even slightly everted. Although the exact taxonomic value of these hemipenial descriptions is as yet unknown, I believe that they will prove to be extremely useful.

### Distribution

Both vertical and horizontal ranges of the individual species have been worked out with great care, and doubtful locality records have been unhesitatingly questioned but only rarely omitted. Names of localities are standardized as fully described in Appendix I. The entire Chinese distribution of every form is given in detail, while all extra-Chinese distributions are included but in much more general terms.

### Habits and Habitat

All scientific data on the habits and habitat preferences of snakes and turtles in China have been given once and credited to the first observer or recorder. In the case of very widely distributed species, published summaries of observations made in extra-Chinese territory have often been

referred to, since, in such cases, it seemed quite unnecessary to cite the original sources.

Special emphasis is placed on life histories, not only because they are in themselves extremely interesting and valuable, but also because the relationships and ranges of many species cannot be understood until the life histories concerned have been thoroughly worked out.

#### **Material Examined**

I have included under this heading all the specimens from China (and some from elsewhere as well) that have been seen by me. In short, I can vouch for the identifications of the specimens listed here. It is my conviction that most of the general faunal and regional works in herpetology are too indefinite to be of real value to the student and yet too technical to help the layman. This section is added as a final precaution to render such criticism inapplicable to the present work.

#### **Remarks**

General or special discussions, subjects requiring special emphasis, and odd points are treated in this, the closing section.

#### **ADDITIONAL EXPLANATIONS**

##### **Rules**

The International Rules of Zoölogical Nomenclature have been interpreted literally and followed in every detail. These rules, together with Opinions 1-123, may be found on pp. 9-92 of an article by Karl Krejci-Graf published in Special Publication, Liang-Kwang Ti-Chih Tiao-Cha-So, Canton, No. 12; 1932.

The name of the author of a species or subspecies is placed in parentheses when, and only when, the generic name used is not identical with that originally applied by the author.

##### **Area**

The area covered exhaustively includes all of China south of a straight line connecting the northern extremity of the Liaotung Gulf with the northernmost point of Kansu. The western provinces of Chinghai and Hsikang are included. Sinkiang (Chinese Turkestan), on the other hand, is omitted. Due to the continuous political changes, it is much simpler to define the northern boundary of the area treated by an imaginary line than by the ever-changing political boundaries.

##### **Period**

All available herpetological literature published from 1758 to 1933,

inclusive, has been drawn upon in writing this book. Some literature dated 1934 has also been included.

#### **Literature Omitted**

Three papers written by P. Pavloff and published in 1932 and 1933, although listed in the Bibliography, have been disregarded elsewhere. This is due to the obvious fact that Pavloff's conception of species and subspecies by no means conforms to that current among herpetologists, and consequently the introduction of his records could result only in great confusion.

## **PART II**

### **SYSTEMATIC ACCOUNT BY SPECIES AND SUBSPECIES**

## PART II

### SYSTEMATIC ACCOUNT BY SPECIES AND SUBSPECIES

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# CHAPTER III

## THE CHELONIANS

### INTRODUCTION

THE reptiles of this order, generally known as turtles, a term somewhat less restricted than the likewise widely used terrapin and tortoise, are perhaps too well known to require special definition. The name chelonian, though not as familiar as those just given, is, nevertheless, the least ambiguous and most definite non-technical one available.

Recent turtles represent much depleted end stages of long evolutionary lines dating from the Triassic. For this reason interrelationships of surviving species are often obscure and many opinions as to the best generic arrangement exist.

Since both Stejneger (1907) and Smith (1931) have given generic synonymies of Asiatic turtles, I have almost entirely omitted them below.

Lindholm (1929, p. 275) has compiled a very useful and well-documented list of the recent chelonians of the world, including genera and higher groups and giving generic types.

### KEY FOR IDENTIFICATION OF CHINESE FAMILIES

- I. Limbs clawless; carapace with seven prominent, longitudinal ridges; size gigantic; marine..... *Dermochelidæ*, p. 20
- II. Limbs with one or more claws; carapace without seven longitudinal ridges
  - A. Shell covered with horny shields
    1. Digits not distinct; limbs paddle-shaped with one or two claws; size large; marine..... *Cheloniidæ*, p. 21
    2. Limbs not paddle-shaped; digits distinct; four or five claws present; not marine
      - a. Plastral shields separated from marginals by inframarginals..... *Platysternidæ*, p. 25
      - b. Inframarginals lacking, plastral shields in contact with marginals..... *Testudinidæ*, p. 27
  - B. Shell covered with soft skin..... *Trionychidæ*, p. 56

## CLASSIFICATION AND DESCRIPTION

Class **REPTILIA**

Order TESTUDINATA

Family DERMOCHELIDÆ

This family includes but a single genus.

Genus **Dermochelys** Blainville

*Dermochelys* Blainville, 1816, Bull. Soc. Philom. Paris, p. 111 bis [=119] (type, *Testudo coriacea*).

The leatherback has frequently been recorded under the generic name *Sphargis* Merrem, 1820.

1. **Dermochelys coriacea** (Linnæus)

Figure 1

*Testudo coriacea* Linnæus, 1766, Syst. Nat., ed. 12, I, p. 350.

*Dermatochelys coriacea* Swinhoe, 1870, Proc. Zool. Soc. London, p. 409 (specimen taken at Amoy and released).

*Dermochelys schlegelii* Stejneger, 1907, Herp. Japan, p. 485 (full synonymy).

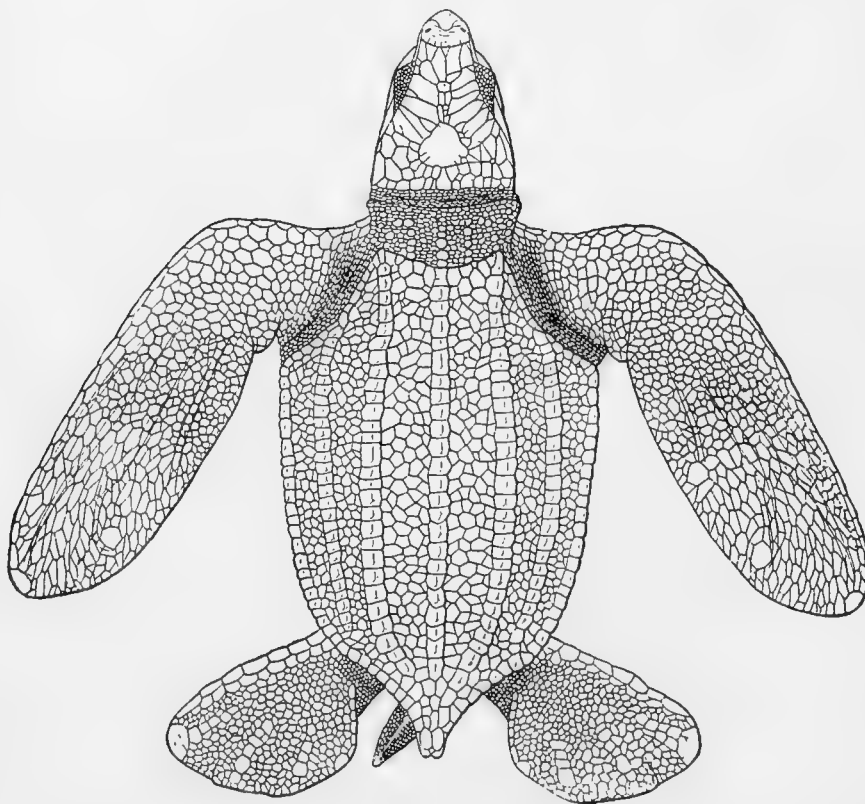


FIG. 1. *Dermochelys coriacea*. Nat. size. Dorsal view of juvenile. U.S.N.M. No. 19796. (From Stejneger.)



*Description*.—This giant among turtles is recognized at once by the absence of horny plates on its back which is covered instead with smooth skin and has seven prominent, longitudinal ridges. In the young, the body and limbs are covered with small, irregularly polygonal shields.

Deraniyagala (1930, p. 54) gives the following dimensions of a "normal female" taken off Ceylon:

Weight.....	301.63 kgms.
Length of carapace along curve of neural ridge.....	1475 mm.
Tip of snout to tip of tail.....	1875

Burne (1905, p. 291) describes in detail the muscular and visceral anatomy of a Japanese specimen.

*Distribution*.—Swinhoe's Amoy record is the only actual proof of the presence of *coriacea* on the coast of China that has come to my notice. Stejneger (1907, p. 487) has summarized early evidence of its occurrence on Japanese coasts.

Widely distributed in tropical seas.

*Habits and Habitat*.—Deraniyagala (1930, p. 48) has given the best account of this turtle and has described its breeding on Ceylon coasts. According to him it lays from 90 to 150 eggs that require probably 65 to 70 days to incubate. The eggs are buried deep, and the site of laying is hidden by the female's plowing up of the sand for about ten square meters all around. The newly-hatched turtles can swim and dive easily. Half-grown specimens are unknown.

*Remarks*.—Stejneger (1907, p. 485) used Garman's specific name, *schlegelii*, but presented no data to substantiate separation of the Pacific from the Atlantic turtles. Smith (1931, p. 59) considers the leatherbacks as representing a single species and in this opinion I concur.

#### Family CHELONIIDÆ

The chelonians of this family are entirely marine. They are generally known as sea turtles. Only three genera exist.

#### KEY FOR IDENTIFICATION OF GENERA

- I. Four pairs of costal shields, the first separated from nuchal by the anterior vertebral
  - A. Two pairs of prefrontals; dorsal shields strongly imbricate in early life, becoming juxtaposed with age..... *Eretmochelys*, p. 22
  - B. A single pair of prefrontals; dorsal shields juxtaposed..... *Chelonia*, p. 23
- II. Five or more pairs of costal shields, the first in contact with nuchal; two pairs of prefrontals; dorsal shields juxtaposed..... *Caretta*, p. 24

Genus *Eretmochelys* Fitzinger

*Eretmochelys* Fitzinger, 1843, Syst. Rept., p. 30 (type, *Testudo imbricata*).

This genus, as here understood, is monotypic.

2. *Eretmochelys imbricata* (Linnaeus)

## Figure 2

*Testudo imbricata* Linnaeus, 1766, Syst. Nat., ed. 12, I, p. 350.

*Eretmochelys squamosa* Stejneger, 1907, Herp. Japan, p. 511 (full synonymy).

*Chelone imbricata* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 109 (specimens, supposedly from the Hainan region, seen in Canton and Hongkong markets).

*Eretmochelys imbricata* Herklots, 1931, Hong Kong Nat., II, p. 82, Pls. III-IV (photograph of specimen taken "off Haiphong . . . not far from . . . Hainan").

*Description*.—Dorsal shields imbricate, becoming juxtaposed with age; margin of carapace including 25 shields, more or less strongly serrated posteriorly; 4 pairs of costal shields; jaws hooked; 2 pairs of prefrontals. Carapace dark brown, marbled with yellow.

The tricarinate condition of the carapace in the young disappears with age.

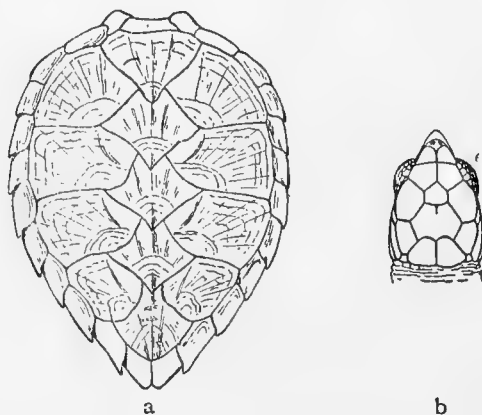


FIG. 2. *Eretmochelys imbricata*. a. Dorsal view of carapace,  $\times \frac{1}{4}$ . b. Dorsal view of head,  $\times \frac{1}{3}$ . (After Stejneger.)

*Distribution*.—This turtle has been recorded with certainty along the coast of China only in the region of Hainan. Stejneger (1907, p. 511) has summarized evidence of its presence in Japanese waters, stating that it is the basis of an important fishery in the Riu Kius and that it occurs on the coasts of Japan proper. Horikawa (1930, p. 23) has recently recorded it from the Pescadores.

Widely distributed in tropical seas.

*Habits and Habitat*.—A recent account of the habits of this turtle has been given by Deraniyagala (1930, p. 72).

*Remarks*.—The hawksbill is the source of the tortoise-shell of commerce.

Genus *Chelonia* Latreille

*Chelonia* Latreille, 1802, Hist. Nat. Rept., I, p. 22.—Fitzinger, 1843, Syst. Rept., p. 30 (type, *Testudo mydas*).

This genus, as here understood, is monotypic.

3. *Chelonia mydas* (Linnæus)

## Figure 3

*Testudo mydas* Linnaeus, 1758, Syst. Nat., Ed. 10, p. 197.

*Chelonia japonica* Stejneger, 1907, Herp. Japan, p. 509, figs. 393-395 (full synonymy).

*Chelone mydas* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 24 (China Seas).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 109 (Hongkong market).

*Description*.—Dorsal shields juxtaposed; margin of carapace including 25 shields not or but feebly serrated posteriorly; 4 pairs of costal shields; jaws not hooked; a single pair of prefrontals. Carapace brown or olive with yellow markings.

The carapace of the young is tricarinate but the lateral keels are very poorly developed.

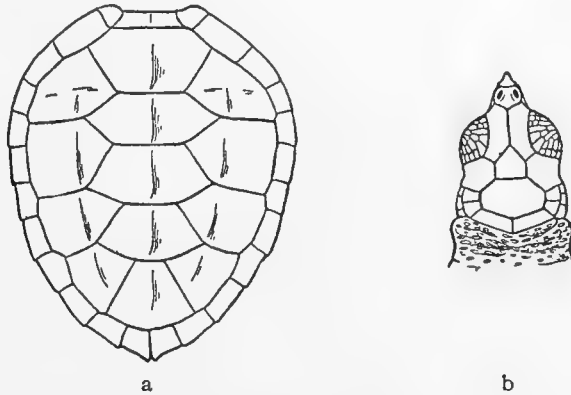


FIG. 3. *Chelonia mydas*. Nat. size. Hatchling. a. Dorsal view of carapace. b. Dorsal view of head. U.S.N.M. No. 7706 from the Bonin Islands. (After Stejneger.)

*Distribution*.—Stanley (1914, p. 24) has listed Chinese material representing this species, and Mell (1922, p. 109) has seen specimens in the Hongkong market but no really definite and concrete records are to be found. Herklots (1931, p. 82) states that it lays eggs on islands near Hongkong in July and August. The green turtle has long been known to occur in Japan and to breed on the Bonin Islands (Stejneger, 1907, p. 510).

*Habits and Habitat*.—Recent accounts of the habits of *Chelonia mydas* have been given by Deraniyagala (1930, p. 67) and Moorhouse (1933, p. 1), the former for the region of Ceylon, the latter for Heron Island, Queensland.

Genus *Caretta* Rafinesque

*Caretta* Rafinesque, 1814, Specchio Sci., Palermo, II, No. 9, p. 66 (type, *C. nasuta* = *Testudo caretta*).

This genus, as here understood, includes two species, the one treated below which is of wide distribution, and *kempii* of the Gulf of Mexico and the seas off the eastern coast of the United States.

4. *Caretta caretta olivacea* (Eschscholtz)

## Plate I

*Chelonia olivacea* Eschscholtz, 1829, Zool. Atlas, p. 2, Pl. III (type locality, Manila Bay).

*Caretta olivacea* Stejneger, 1907, Herp. Japan, p. 507, Pl. xxiv (full synonymy).—Sowerby, 1925, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) LVI, p. vii (Hwangpu above Shanghai); 1929, China Journ., XI, p. 45, Pl. (between the Four Sisters and Two Brothers Islands east of Chusan Island, about 29° N. Lat. by 123° E. Long.).

*Thalassochelys caretta* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 24 (China Seas).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 109 (markets of Canton and Hongkong).

*Description*.—Dorsal shields juxtaposed; margin of carapace including 23 to 27 shields, more or less serrated posteriorly; at least 5 pairs of costal shields; jaws strongly hooked; 2 pairs of prefrontals. Carapace brown.

There are few data available on the number of marginals in Pacific specimens (*caretta olivacea*), but Coker (1910, p. 61) found that, in Atlantic material (*caretta caretta*), an equal number of individuals have 12 and 13, while the nuchal is occasionally divided. The number of shields included in the margin

TABLE I. DORSAL SCUTES AND DIMENSIONS OF *CARETTA CARETTA OLIVACEA*

Authority	Locality and Shanghai Mus. No.	Costals	Marginals	Nuchal	Remark or Length of Carapace Along Curve
Sowerby.....	Fukien Coast No. 2579	Right 7 Left 6	Right 12 Left 12	Divided trans- versely?	880 mm.
Sowerby.....	Fukien Coast No. 2580	Right 5 Left 5	Right 11 Left 11	Single	1014 mm.
Sowerby.....	Hwangpu No. 2581	Right 5 Left 5	Right 11 Left 12	Single	1027 mm.
Smith.....			Nuchals + Marginals 27, rarely 25		A general statement for <i>olivacea</i>
Deraniyagala ..	Ceylon		13, occasion- ally 14	Frequently divided	General statements

of the carapace in *caretta caretta* may, therefore, be put down as 25 or 27, occasionally 26 or 28. These figures do not include abnormal and asymmetrical arrangements. Both Smith (1930, p. 71) and Deraniyagala (1930, p. 79) give the marginal counts of Pacific (*caretta olivacea*) specimens as somewhat higher than those included in data on three Chinese individuals in the Shanghai Museum of the Royal Asiatic Society kindly furnished me by Mr. Sowerby. Table I illustrates this point in detail.

The number of costals is very variable, but Pacific specimens have a definitely higher average count than those from the Atlantic (Coker, 1910, p. 62; Deraniyagala, 1930, p. 82; Babcock, 1930, p. 95) and I therefore consider Smith's (1930, l.c.) use of a trinomial justifiable.

The tricarinate condition of the carapace in the young disappears with age.

*Distribution*.—This turtle has long been known to breed on the southern coasts of Japan through the summer months as shown by Stejneger (1907, p. 508). Tomita (1929, p. 351) states that, in this region, *olivacea* lays from 10 to 14 dozen eggs requiring 6 to 8 weeks for incubation. More definitely, he gives 47 days as the usual period from laying to hatching. In spite of its abundance in Japanese waters, Sowerby's two records (Hwangpu; and between the Four Sisters and Two Brothers Islands situated east of Chusan Island) are the only really concrete ones for definite Chinese localities.

Widely distributed in tropical and semi-tropical Pacific waters.

*Habits and Habitat*.—The habits of this turtle have already been touched upon but it might be added here that the stomach of the Hwangpu example referred to above was full of crab remains (Sowerby, 1929, p. 45). Deraniyagala (1930, p. 81) gives additional notes on the feeding and other habits of the loggerhead.

#### Family PLATYSTERNIDÆ

This family includes but a single genus.

#### Genus *Platysternon* Gray

*Platysternon* Gray, 1831, Proc. Zool. Soc. London, p. 106 (type, *P. megacephalum*).

There is only one species in the genus *Platysternon*.

#### 5. *Platysternon megacephalum* Gray

##### Figure 4

*Platysternon megacephalum* Gray, 1831, Proc. Zool. Soc. London, p. 107 (type locality, China).

*Platysternum megacephalum* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 108 (Lofaoshan, 400-500 meters; Tinghushan; near Hunan-Kiangsi boundary, 550-800 meters; and east of Shiuchow, 550-800 meters, four Kwangtung locality records).—Fang, 1930, Sinensia, Nanking, I, p. 96, figs. 1-2 (Sanfang, Kwangsi).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 142 (Lohsiang, Chinsiu and Kuchen, Kwangsi).

*Description*.—This remarkable turtle is immediately recognized by its depressed form, long tail and large head. The latter cannot be drawn into the shell. Schmidt (1927, p. 401) records a Hainan specimen with a carapace 184 mm. long. Sixteen examples listed by him from Hainan had the following average dimensions:

Length of carapace.....	136 mm.
Width of carapace.....	101
Depth of shell.....	43
* Length of plastron.....	107
Length of tail.....	146

Siebenrock (1907, p. 1742) has given a full account of the anatomy of this interesting turtle. He states that the cloaca is situated more posteriorly and that the tail is the thicker in the male (p. 1757).

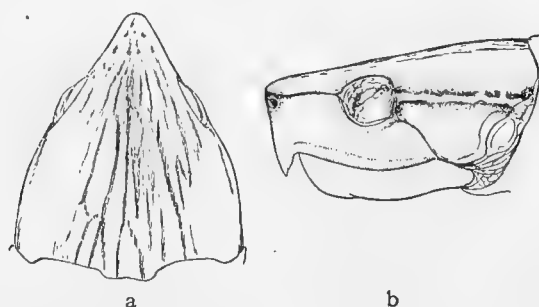


FIG. 4. *Platysternon megacephalum*. Nat. size. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 30109 from Hainan.

*Distribution*.—In China, *megacephalum* has been frequently reported from Kwangtung, including Hainan, and Kwangsi. It is also known along the coast to the region of Foochow.

Distributed from southern Burma eastward through Siam and Indo-China to China.

*Habits and Habitat*.—*P. megacephalum* frequents mountain streams. Mell (1922, p. 108) reports it from 400 to 800 meters above sea-level in Kwangtung, while Boulenger (1893, p. 311) describes a specimen taken at 3000 feet in the Karin Hills, Burma. On Hainan, it was not found near Nodoo but only in the mountains to the south (Schmidt, 1927, l.c.).

Smith (1931, p. 74) states that "it is a good climber, ascending trees and rocks in search of food and to bask in the sun." It is, however, nocturnal (Mell, 1929, p. 234).

In captivity, it has been described as eating meat, snails, worms, and fish (Fea, 1897, p. 449; Smith, 1931, l.c.; Siebenrock, 1907, p. 1757).

*P. megacephalum* lays but 2 eggs at a time (Mell, 1929, p. 192).

It has a fierce disposition and bites freely when annoyed, often holding the mouth open while on the defensive (Fea, 1897, l.c.; Siebenrock, 1907, p. 1758; Schmidt, 1927, l.c.; and Mell, 1929, p. 234, fig. 18). I observed in the field that specimens have a tendency to hold on while biting. They also hiss when disturbed and, if tapped on one side of the shell, raise the opposite side.

When walking, *megacephalum* advances at the rate of 25-27 feet per minute (Schmidt, 1927, l.c.).

*Material examined*:—I have seen the following specimens from China: 17 from Hainan, 5 from Amoy, and 1 from the Foochow region, in the American Museum; the type, and another example with no more definite locality than southern China, in the British Museum; and 1 from Lohsiang, in the Museum of Comparative Zoölogy.

*Remarks*:—*P. megacephalum* is eaten in Burma and China (Fea, 1897, l.c.; Mell, 1922, l.c.; and Fang, 1930, p. 100). The shell is used in making medicine (Fang, 1930, l.c.).

#### Family TESTUDINIDÆ

The term Testudinidæ as employed here includes the Emydidæ and Testudinidæ of the classification adopted by Smith (1931, p. 55). His Testudinidæ includes but a single Asiatic genus, namely, *Testudo*, and is equivalent to the term Testudininae as used below.

*Damonia? crassiceps* Gray, 1870, p. 43, based on a sketch by Reeves, has been tentatively placed in the synonymy of *Damonia subtrijuga* by Smith (1931, p. 105). The generic name *Damonia* is, however, no longer valid but must be replaced by *Malayemys* Lindholm, 1932 (p. 30).

#### KEY FOR IDENTIFICATION OF CHINESE GENERA

- I. Limbs more or less flattened; digits webbed; top of head covered anteriorly with undivided skin; costal plates not wedge-shaped with alternating broad and narrow ends
  - A. Hexagonal neural plates short-sided behind
    1. Plastron hinged; plastron connected with carapace by a ligament..... *Cyclemys*, p. 28
    2. Plastron not hinged; plastron directly united with carapace..... *Geoemyda*, p. 35
  - B. Hexagonal neural plates short-sided in front; plastron not hinged; plastron directly united with carapace
    1. Entoplastron intersected by gularohumeral suture
      - a. Alveolar surface of upper jaw without a longitudinal, median ridge

- (1) Top of head covered posteriorly with smooth undivided skin; alveolar surfaces of jaws narrow. . . . . *Clemmys*, p. 37
- (2) Top of head covered posteriorly with small shields or granular skin; alveolar surfaces of jaws broad. . . . . *Geoclemys*, p. 43
- b. Alveolar surface of upper jaw with a longitudinal, median ridge; top of head covered posteriorly with undivided skin; sides of head with numerous, narrow, longitudinal, yellow stripes. . . . . *Ocadia*, p. 48
- 2. Entoplastron not intersected by gularohumeral suture; entoplastron broader than long . . . . . *Pseudocadia*, p. 50
- II. Limbs more or less cylindrical, the posterior pair club-shaped; digits not webbed; top of head covered anteriorly with shields; costal plates wedge-shaped with alternating broad and narrow ends. . . . . *Testudo*, p. 54

No difficulty should be encountered in identifying Chinese turtles if the following facts are kept in mind:

1. As a rule chelonians change their shape and general appearance with age, and therefore individuals of an ontogenetic series must not be expected to resemble one another too closely.
2. With the exception of the hinged condition of the plastron and the relation of the plastron to the carapace, the value of the characters used in the foregoing key should not be affected by ontogenetic change. In juvenile specimens of *Cyclemys* the hinge of the plastron and the ligamentous connection of carapace and plastron are not readily detected.
3. The head pattern of turtles is characteristic of and remarkably constant in each species and should be frequently relied upon in identifications. The illustrations are especially valuable in this respect.

#### Genus *Cyclemys* Bell

This genus is made up of several species distributed from Assam, southern China, the Riu Kiu Islands and Formosa southward through the peninsula of southeastern Asia into the Malay Archipelago.

It is entirely possible that *Cyclemys amboinensis* (Daudin) occurs in China, but I have not included it below because one of the two Chinese records of it is old, the other somewhat indefinite. Both of these records possibly could have been based on imported specimens. The abundance of *amboinensis* in the Malay Archipelago and the southern part of the peninsula of southeastern Asia means that it might readily find its way to China by boat. The two records just referred to follow:

*Cistudo Amboinensis* Duméril and Duméril, 1851, Cat. Méthod. Rept. Mus. Paris, p. 7 (China).

Doctor Angel has kindly written me that the specimen on which this record was based still exists in the Paris Museum and that its identity is correct.



*Cyclemys flavomarginata* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 108 (Tung Kiang region, Kwangtung) (not of Gray, 1863).

Doctor Mell has informed me that the specimens on which this record was founded were bought by him in the Canton market and subsequently lost. They were stated to be from the region cited above.

In *C. amboinensis* the carapace is not strongly tricarinate or flattened middorsally, nor is its posterior margin serrated. The plastron is rounded or feebly notched behind, the sole of the foot covered with numerous, small, flat scales and the temporal arch complete. The last two characters serve to distinguish it from *flavomarginata*, for in that species the sole of the foot has only six to eight large flat scales while the temporal arch is incomplete posteriorly.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Carapace strongly tricarinate, flattened between the lateral keels, posterior margin serrated..... *mouhotii*, p. 31
- II. Carapace not or only feebly tricarinate, not flattened middorsally, posterior margin not serrated
  - A. Plastron rounded or feebly nicked posteriorly..... *f. sinensis*, p. 29
  - B. Plastron distinctly notched posteriorly
    - 1. Top of head largely light yellow; plastron black with narrow, yellow margins..... *trifasciata*, p. 32
    - 2. Top of head dark olive, margined with yellow; plastron dull yellow save for a large reddish blotch in each shield..... *yunnanensis*, p. 34

#### 6. *Cyclemys flavomarginata sinensis* Hsü

Figure 5

*Cyclemys flavomarginata sinensis* Hsü, 1930, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VI, p. 1, figs. 1-3 (type locality, Chunshan Id., Tungting Lake, Hunan).

**Description:**—The original description, apparently based on the type, together with measurements of the paratype, follow:

Snout short, not projecting, lateral profile vertical, straight. Edge of jaws not denticulated. Upper jaw rather strongly hooked. Mandibular symphysis equal to the length of eye slit. Body not at all depressed, its depth being less than one half its width. Carapace wider behind the middle, slightly emarginate in front. Shields with rather small areoles and wide margins with numerous deeply cut concentric lines. Vertebral keel more prominent in the center of each shield and sharply interrupted on the junction of the third and fourth vertebrals. A small longitudinal keel-like structure in the center of each costal areole. Nuchal rather large, broader behind than in front, longer than broad, with horizontally cut parallel lines covering its posterior two thirds. With exception of the fifth, all vertebrals emarginate behind, such character more pronounced in the case of the fourth. First vertebral narrowest, breadth about equal to length. Second vertebral longest, longer than broad. All the follow-

ing broader than long. Each of the five vertebrals narrower than its adjacent costal. The first marginal as well as the sixth-tenth broadest. Lateral edge of each marginal slightly flaring and overlapping its following one, so as to make the margin of the carapace more or less serrate, especially on its posterior region of the shell. A slight notch between the two anals. Plastron flat, but depressed obviously in the gular and a part of the humeral region and slightly in the anal region; obtusely emarginate in front, round behind. Each shield with deeply cut parallel lines, mostly around the anterior and medial margins. Demarcation between each two adjacent shields not very obvious, especially that between the femoral and anals. A ligamentous hinge between pectoral and abdominal shield. Plastron fastened to carapace with ligament. Abdominal seam longest; anal seam disappearing near the posterior ends of the plates and the length of the part which is still distinct equal to that of humeral and gular taken together. Pectoral seam longer than gular but shorter than both humeral and gular together. Humeral and femoral seams very short, either of them slightly longer than one fourth the abdominal seam. Front part of arm with very large scales with free, round edges. Digits slightly webbed at base and with blunt claws. Base of tail and its adjacent regions with numerous blunt tubercles.

COLOR (in formalin): Carapace blackish brown. Each areole dark chestnut. Median keel in the first vertebral dark chestnut; in the second somewhat rufous brown; in the third somewhat rufous; and in fourth and fifth somewhat buff. Plastron uniformly black, except narrow outer margin on pectoral, abdominal, femoral and anal shields pale buff. Marginals underneath pale buff, except a very narrow outer margin blackish brown. Top of head pale olive green. From the upper posterior angle of the orbit to side of the occiput, extending two adjacent bands, the upper one yellow in color and the lower one olive green, each longitudinally bordered with black lines; posterior part of the lower band passing into the brownish ashy color of the neck. Side of head somewhat pale buff. Maxilla pale greenish yellow. Mandible buff with reddish color on the symphysis region. Brownish ashy color of neck extending to shoulder. Legs dirty olive green dorsal and pale buff ventral. Tail dark brownish ashy above, with dirty olive green, longitudinal band on each side and on the middle line above, but entirely pale buff below.

## MEASUREMENTS

M.B.L.S.S.C. No.	1175, Type	1174, Cotype
Sex	♀	♀
Length of carapace	153 mm.	156 mm.
Breadth of carapace	112	112
Depth	70	72
Length of plastron	147	152
Breadth of plastron	88	89
Gular seam	26	24
Humeral seam	10	11
Pectoral seam	30	33
Abdominal seam	38	39
Femoral seam	9	12
Anal seam (coalesced portion excluded)	33	28
Anal seam (coalesced portion included)	38	38
Width of head	22	25
Length of tail from vent.	18	18

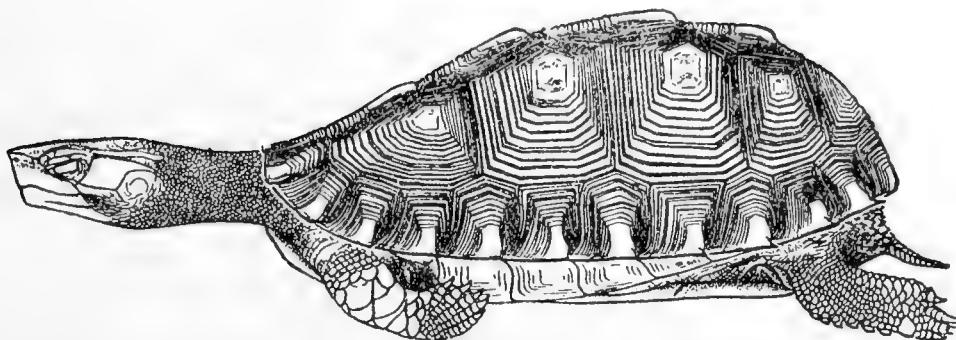


FIG. 5. *Cyclemys flavomarginata sinensis*. Type.  $\times \frac{1}{2}$ . (From Hsü.)

*Distribution*.—*C. flavomarginata sinensis* is known only from Chunshan, its type locality.

Although *flavomarginata* was originally described by Gray (1863, p. 175) from China and Formosa, Boulenger later (1889, p. 135) questioned the correctness of China, and no specimen of undoubted Chinese origin has been reported since (compare Hsü, 1930, p. 1). Smith (1931, p. 87) includes "southern China as far south as the West River" in its range but he was influenced by Mell's 1922, p. 108, record which is now known to have been based on *Cyclemys amboinensis* as already explained above.

*Habits and Habitat*.—The apparent confinement of this form to a tiny, low island in the Tungting Lake is most interesting. I can confirm Hsü's statement that inhabitants of the Tungting Lake region unanimously insist that this turtle is a peculiarity of Chunshan not found elsewhere about the lake.

*Remarks*.—With the single exception of tail length, all the characters enumerated in Hsü's diagnosis (p. 3) as distinguishing *sinensis* from typical *flavomarginata* are either common kinds of variations to be expected in almost any emydid turtle or else differences generally correlated with age. However, until direct comparison of Chinese with Japanese material can be made it is just as well to consider the forms subspecifically distinct.

#### 7. *Cyclemys mouhotii* Gray

##### Figure 6

*Cyclemys Mouhotii* Gray, 1862, Ann. Mag. Nat. Hist., (3) X, p. 157 (type locality, Laos Mountains, Annam-Siam border).

*Pyxidea mouhotii* Gray, 1863, Proc. Zool. Soc. London, p. 175.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 407, fig. 6 (Namfong, Hainan).

*Description*.—Carapace tricarinate, flattened between keels, depressed, serrated before and behind; nuchal shield long and narrow; plastron a little smaller than opening of shell, truncate anteriorly, notched posteriorly; longest

median suture between abdominal, shortest between gular shields; bridge short but distinct; skin of posterior part of head broken up into shields. Shell light brown above, uniform or with dark brown exterior to lateral keels; yellowish brown below. (Description based on that of Smith, 1931, p. 78.)

The dimensions of the Hainan female described by Schmidt (1927, p. 407) follow:

Length of carapace.....	163 mm.
Width of carapace.....	119
Depth of shell.....	67

In this specimen, the shortest median suture is between the humeral shields, and the first vertebral is as broad in front as behind. The head is yellowish brown above with dark vermiculations, while laterally it is dark with light vermiculations. There is a small, dark-edged temporal spot on either side. Each costal shield includes a large dark area.

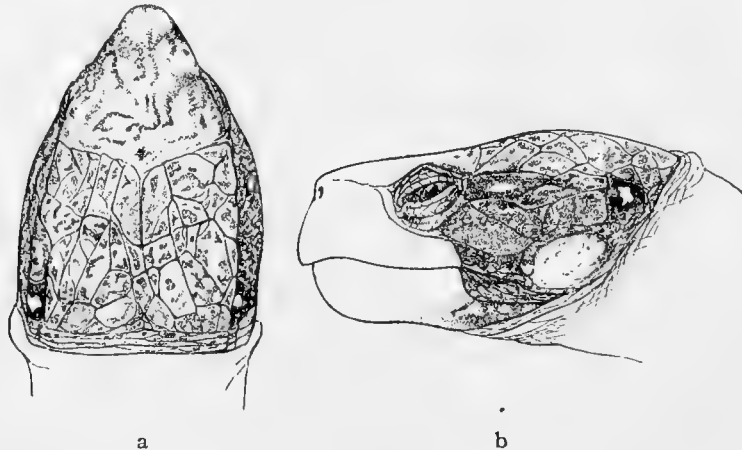


FIG. 6. *Cyclenys mouhotii*. Nat. size. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 28336 from Namfong, Hainan.

*Distribution*.—Recorded only from Namfong, Hainan, in China. Known also from Indo-China, including Tongking.

*Habits and Habitat*.—This species apparently inhabits mountainous country.

*Material examined*.—I have seen the specimen from Namfong, Hainan, in the American Museum.

#### 8. *Cyclenys trifasciata* (Bell)

##### Figure 7

*Sternotherus trifasciatus* Bell, 1825, Zool. Journ., London, II, p. 305, Pl. xiv [xiii] (type locality unknown).  
*Cistuda trifasciata* Gray, 1831, Synop. Rept., pp. 19 and 71 (China).  
*Cuora trifasciata* Gray, 1855, Cat. Sh. Rept. Brit. Mus., pt. 1, p. 42.

? *Pyxidemys trifasciata* Fitzinger, 1861, Sitzber. Akad. Wiss. Wien (math.-natur.), XLII, p. 411 (Shanghai).  
*Terrapene trifasciata* Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 104.  
*Cyclemys trifasciata* Boulenger, 1889, Cat. Chel. Brit. Mus., p. 133.—Siebenrock, 1907, Sitzber. Akad. Wiss. Wien (math.-natur.), CXVI, Abt. I, p. 1763 (Kwangtung or Kwangsi).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 108 (Tinghushan, Wuyung, Namkong and Lofaoshan, all in Kwangtung, 50-400 meters).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 405, fig. 5 (Hainan).—Fang, 1930, Sinensia, Nanking, I, p. 108, fig. 5 (Nanning market and Shihwantashan, Kwangsi).  
*Emys trifasciata* Strauch, 1890, Mém. Acad. Imp. Sci. St. Pétersbourg, (7) XXXVIII, No. 2, p. 65 (Canton).

*Description*.—Carapace tricarinate, the middorsal keel much the more prominent; first vertebral shield distinctly wider in front than behind; plastron about as large as opening of shell, rounded anteriorly, notched posteriorly; longest median suture between abdominal or pectoral, shortest between humeral shields; no distinct bridge; upper jaw feebly hooked; skin of head broken up only at posterior margin. Head yellow above and below, mahogany laterally save for a yellow blotch behind eye and a yellow line extending backward from the upper jaw which is also yellow; carapace brown or blackish, the keels black; plastron black with narrow yellow margins better developed laterally and a central yellow area sometimes present.

Length of carapace.....	173 mm.
Width of carapace.....	122
Depth of shell.....	65

(Description based on Hainan series.)

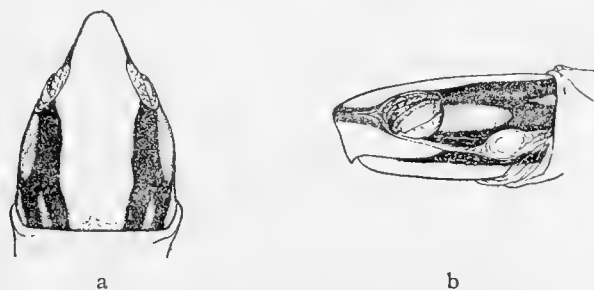


FIG. 7. *Cyclemys trifasciata*. Nat. size. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 30144 from Hainan.

*Distribution*.—*C. trifasciata* is well known from southern Kwangtung and Hainan. It has also been collected at Shihwantashan in southwestern Kwangsi. Records for other provinces are probably based on commercial specimens since this species is constantly sold in markets of southern China (Schnee, 1899, p. 320, and Fang, 1930, p. 111).

*Habits and Habitat*.—Mell (1922, p. 108) found *trifasciata* in clear mountain and hill streams of southern Kwangtung from 50 to 400 meters altitude, while I secured it in abundance near Nodda, Hainan.

This turtle lays two white, oval eggs at a time (Schmidt, 1927, p. 407,

and Mell, 1929, p. 192). A female containing eggs measuring 27 x 50 mm. and apparently ready to be laid was killed at Nodoa May 17 (Schmidt, 1927, l.c.). This gives some indication of the laying season on Hainan.

Schnee (1899, l.c.) and Bruner (1908, p. 749) have given accounts of this interesting turtle in captivity, and Flower (1925, p. 923) records a living specimen that had already survived 18 years and 8 months of confinement. According to Schnee, *trifasciata* prefers earthworms as a diet, is very shy and relatively terrestrial in confinement.

*Material examined*.—I have seen the following material: 28 examples from Hainan, in the American Museum; several from China, in the British Museum; 1 from "China," in the United States National Museum; and 2 of indefinite origin, in the Museum of Comparative Zoölogy.

#### 9. *Cyclemys yunnanensis* Boulenger

Plate II, C

*Cyclemys yunnanensis* Boulenger, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 567 (type localities, Yunnanfu and Tungchwan, Yunnan).

*Cuora yunnanensis* Smith, 1931, Fauna Brit. India, Rept. Amphib., I, p. 88, Pl. II.

*Description*.—The original description follows:

Carapace much depressed, tricarinate, the median keel much stronger than the laterals, the posterior border slightly serrated in the young, entire in the adult. Vertebral shields as long as broad and much narrower than the costals in the adult; nuchal shield moderate, square or trapezoid. Plastron large, but not completely closing the shell, hind lobe openly emarginate and a little longer than the bridge; transverse hinge distinct but feeble; axillary and inguinal shields small; suture between the gulars three to four times as long as that between the humerals and as long as or a little shorter than that between the pectorals, the femorals, or the anals, which are nearly equal and longer than that between the abdominals. Snout prominent, pointed; upper jaw not hooked. Digits webbed to the claws, which are long, curved, and sharp. Front part of forelimb with band-like transverse shields. Carapace olive-brown or chestnut-brown, the edge and the keels sometimes yellowish; plastron brown or olive, yellowish on the border, the sutures blackish. Head olive, with a narrow yellow line on each side, passing through the eye; chin and throat marbled with orange; two narrow orange streaks on each side of the neck; limbs with orange spots and streaks. Length of shell 140 mm.

*Distribution*.—This species is known only from the type localities.

*Habits and Habitat*.—*C. yunnanensis* is apparently an inhabitant of considerable altitudes, for Yunnanfu is 6400 feet above sea-level, while Tungchwan is 850 feet higher.

*Material examined*.—I have seen 6 cotypes from Tungchwan and Yunnanfu, in the British Museum.

Genus *Geoemyda* Gray

*Geoemyda* Gray, 1834, Proc. Zool. Soc. London, p. 100 (type, *Testudo spengleri*).

This genus is widely distributed in southern Asia from Peninsular India to the Riu Kiu Islands and southward into the Malay Archipelago. It also occurs in Mexico and Central and South America. Although only one of the seven Asiatic species can now be included in the fauna of China, another form, designated by Smith (1931, p. 98) as *G. trijuga edeniana* (Theobald), has long been known from the region of Bhamo (Anderson, 1879, p. 723, as *Emys trijuga*, variety *burmana*; and Boulenger, 1888, p. 593) and there closely approaches the confines of western China.

10. *Geoemyda spengleri spengleri* (Gmelin)

Plate II, A and B

Spenglerischen Schildkröte, Walbaum, 1785, Schrif. Berlin Gesell. Naturf. Freunde, VI, p. 122, Pl. III (probably brought from "Ostindien").

*Testudo Spengleri* Gmelin, 1789, Syst. Nat., I, p. 1043 (no locality given).

*Geoemyda Spengleri* Gray, 1834, Proc. Zool. Soc. London, p. 100 (China).—Siebenrock, 1907, Sitzber. Akad. Wiss. Wien (math.-natur.), CXVI, Abt. I, p. 1760 (Kwangtung and Kwangsi).

*Nicoria Spengleri* Gray, 1855, Cat. Sh. Rept. Brit. Mus., pt. 1, p. 17.—Boulenger, 1889, Cat. Chel. Brit. Mus., p. 120.

*Clemmys Spengleri* Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 106.

*Geoemyda spengleri* Fang, 1930, Sinensia, Nanking, I, p. 118, fig. 7 (Tungkueihsu of Lungchow, and Lingtung of Sanfang, Kwangsi).

*Geoemyda spengleri sinensis* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 146 (type localities, Lohsiang and Kuchen, Kwangsi).

*Description*.—Carapace depressed and tricarinate, serrated before and behind, especially behind; nuchal large, broader behind; plastron angulate laterally, openly emarginate anteriorly, notched posteriorly; longest median suture between abdominal, shortest between gular shields; axillary and inguinal shields absent; upper jaw hooked; skin of posterior part of head smooth. Brown above, more or less variegated with blackish or yellowish; black below with yellow on bridge, serrated ends of marginals and margin of plastron.

Length of carapace.....	116 mm.
Width of carapace.....	77
Depth of shell.....	43

The male has a thicker, longer tail and a more posteriorly situated cloaca than the female, while there is a concavity in the plastron of the male but not in that of the female (Siebenrock, 1907, p. 1761).

*Distribution*.—In China, *G. spengleri spengleri* is known with certainty only from Kwangsi and Kwangtung. It has been collected in the northern, eastern and extreme southwestern sections of Kwangsi but from no definite locality in Kwangtung. Mell's failure to secure it is good evidence that it is

lacking over much of northern and eastern Kwangtung although it is obviously to be expected in certain parts of that province that lie adjacent to Kwangsi.

*G. spengleri spengleri*, as considered here, is found in Annam and the Malay Archipelago, as well as in southern China.

*Habits and Habitat*.—The field observations of Fang (1930, p. 121) confirm the conclusion of Siebenrock (1907, p. 1762) that this turtle is semi-aquatic as well as terrestrial. Siebenrock observed the webbing of the digits. Its abundance in Yaoshan (Fan, 1931, p. 146) may be taken as evidence that it likes wild, wooded, mountainous country.

*Material examined*.—I have seen 1 example from Lohsiang, 1 from Annam, and 1 without more definite designation than "China," in the British Museum; 1 from Lohsiang and 1 from "China," in the Museum of Comparative Zoölogy; and 1 from Lohsiang, in the United States National Museum.

I have also seen 4 Riu Kiu examples of *spengleri japonica*.

*Remarks*.—Stejneger (1907, p. 502) remarked on certain differences between Riu Kiu specimens examined by him and Chinese material described by Boulenger. Fang (1930, l.c.) also observed that his Kwangsi examples agreed with Boulenger's description rather than with that of Stejneger. Finally, Fan (1931, l.c.) described a large series of *spengleri* from Yaoshan as a new subspecies which he named *sinensis*. Then, on page 148, he proposed the name *japonica* for *spengleri* from "Japan and other Pacific islands," reserving *sinensis* as designating the mainland form. In doing this, Fan made three errors:

1. He overlooked the fact that there must necessarily be a typical form if subspecies are to be erected.
2. He failed to determine both the origin and the character of the material on which the original *spengleri* was founded.
3. In defining his ranges, he did not take into full consideration distributional probability, or even previous descriptions.

I have, with considerable trouble, determined the following points:

(a) The original type, described without assignment of a definite name by Walbaum, probably came from the East Indies, and lacks inguinal and axillary shields, while the order in length of plastral sutures is abdominal, humeral = pectoral = femoral, anal, gular (Walbaum, 1785, pp. 128-130).

(b) The presence or absence of axillary shields is a good character, while the relative length of the plastral sutures is too variable to be relied upon.

(c) All the material from China and regions to the south, including the East Indies, uniformly lacks both axillary and inguinal shields (Boulenger, 1889, p. 121, and de Rooij, 1917, p. 299), while that from the Riu Kiu Islands always has at least one axillary and sometimes a trace of an inguinal.



Putting two and two together, it may be concluded that:

I. There are two forms of *spengleri*, one inhabiting some of the Riu Kiu Islands, the other widely distributed from southern China into the East Indies.

II. The widely distributed form must be called *spengleri spengleri* because it agrees with the type in lacking both axillary and inguinal shields and because the type, in all probability, came from some locality within the range of this widely distributed subspecies. The form local to the Riu Kiu Islands may be called *spengleri japonica* Fan.

III. The fact that the Riu Kiu fauna is well known to be localized, and that many reptiles and amphibians are distributed from southern China into the Malay Archipelago, lends support to the distribution of *spengleri* outlined above, while the ranges assigned by Fan are without parallel in herpetology.

Finally, it should be stated that this problem needs further study, for I believe it is entirely possible that two full species rather than two forms of a single species may be involved. Fang (1930, l.c.) has enumerated, in addition to those considered above, several characters as characteristic of mainland vs. Riu Kiu material, but, among them, the proportions of the nuchal shield and the presence or absence of spines at the base of the tail are not diagnostic of specimens from either region (de Rooij, 1917, p. 299, fig. 110,<sup>1</sup> and Fan, 1931, p. 148), while the degree of serration of the carapace can scarcely be looked upon as a good character.

#### Genus *Clemmys* Ritgen

*Clemmys* Ritgen, 1828, Nova Acta Acad. Leop. Carol., XIV, p. 272.—Stejneger, 1907, Herp. Japan, p. 492 (*Emys punctata* named as type).

*Cathaiemys* Lindholm, 1932, Zool. Anz., XCVII, p. 29 (type, *E. muticus*).

In addition to those treated below, only one species of this genus, *C. japonica* of Japan, is found in all central and eastern Asia; the rest occur in southwestern Asia, southern Europe, northwestern Africa and North America.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Plastron emarginate posteriorly; top of head with one or two pairs of ocelli situated posteriorly; shell with more or less widely distributed vermiculations, small spots or short streaks
  - A. Save for ocelli, top of head uniform olive or chocolate brown. *quadriocellata*, p. 41
  - B. Save for ocelli, top of head grayish olive with black vermiculations. *bealei*, p. 38
- II. Plastron deeply notched posteriorly; top of head without ocelli; shell without vermiculations, small spots or short streaks
  - A. Chin and throat uniform light yellow. *mutica*, p. 39
  - B. Chin and throat yellow with conspicuous black markings and mottling. *nigricans*, p. 40

<sup>1</sup>Reproduced herein as Plate II, A and B.

11. *Clemmys bealei* (Gray)

## Plate III

*Cistuda Bealei* Gray, 1831, Synop. Rept., p. 71 (type locality, China).

*Emys Bealii* Gray, 1834, Proc. Zool. Soc. London, p. 54; 1855, Cat. Sh. Rept. Brit. Mus., pt. 1, p. 21, Pl. VIII.

*Sacalia Bealii* Gray, 1870, Suppl. Cat. Sh. Rept. Brit. Mus., I, p. 35.

*Clemmys bealii* Boulenger, 1889, Cat. Chel. Brit. Mus., p. 107.—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 364 (Futsing Hsien and Foochow [region], Fukien).

*Description*.—*C. bealei* differs only in coloration from the better known *quadriocellata* as follows:

1. The dorsal surface of the head in *quadriocellata* is, save for the ocelli, uniform olive or chocolate brown, while in *bealei*, it is grayish olive finely vermiculated with black.
2. In *bealei*, this vermiculation may encroach upon and absorb the anterior ocelli, and these ocelli, when not obliterated by encroachment of the vermiculation, have two black spots each, instead of only one as in *quadriocellata*. Moreover, the posterior ocelli of *bealei* often have two spots each, while the anterior and posterior ones tend to run together, conditions never found in *quadriocellata*.
3. The shields on the anterior aspect of the lower forelimb in *bealei* are yellow, and contrast strongly with the brown ones of the lateral aspect; in *quadriocellata*, the lower anterior forelimb shields are light, those on the sides dark brown, no conspicuous contrast in color being evident.
4. The carapace and plastron of *bealei* are rather conspicuously and more or less completely vermiculated, a condition approached only by the plastral spots of *quadriocellata* which may form short lines but not true vermiculations. However, the pattern of the shell is not to be relied upon too much because it will doubtless prove to be least reliable of all the characters given.

The measurements of the Futsing Hsien (Nos. 34198-9) and Foochow region (Nos. 35179-80) specimens in the American Museum are given in Table II.

TABLE II. MEASUREMENTS OF *CLEMMYS BEALEI*

Amer. Mus. No.	Sex	Length Carapace	Breadth Carapace	Depth	Length Plastron	Length Tail
34198	♂	141 mm.	96 mm.	47 mm.	120 mm.	31 mm.
34199	♂	129	89	47	111	28
35179	♂	131	92	48	112	29
35180	♀	138	95	47	113	35

There is no bright yellow in any of the ocelli of the Fukien series, a probable result of the obvious maturity of this material. In life, the plastron, fleshy parts and eyes of the Futsing Hsien specimens were pink.

*Distribution*.—*C. bealei* is known only from the cotypes and the 4 speci-

mens collected by me in Fukien: 2 from Futsing Hsien, and 2 from the region of Foochow.

*Habits and Habitat*.—Probably like those of *quadriocellata*. The Futsing Hsien specimens were secured in the mountains surrounding Lingshihszu.

*Material examined*.—I have seen the type material, in the British Museum; 2 specimens from Futsing Hsien, and 2 from the Foochow region, in the American Museum.

*Remarks*.—*C. bealei* and *quadriocellata* are confused in the literature because too much emphasis has been placed on the number of ocelli and because no other worker has been able to compare good series of the two forms from definite localities. Either species may have four ocelli. True *quadriocellata* always has the full set, while, in *bealei*, the anterior one on either side is often absorbed by the vermiculation of the head. This vermiculation is really the essential character used to separate the forms. The stuffed type of *bealei* plainly shows the head vermiculations (described as "speckled" by Boulenger, 1889, p. 107) and the very fact that only the posterior ocelli are shown in the figure (Gray, 1855, Pl. VIII<sup>1</sup>) is proof of the relative obscurity of the anterior ones, a condition characteristic of *bealei*. The pattern of the carapace in the figure is also like that of the new Fukien material as described above.

## 12. *Clemmys mutica* (Cantor)

### Figure 8

*Emys muticus* Cantor, 1842, Ann. Mag. Nat. Hist., IX, p. 482 (type locality, Chusan Id., Chekiang).

*Emys nigricans* Gray, 1855, Cat. Sh. Rept. Brit. Mus., pt. 1, p. 20, Pl. xv (part).

*Damonia nigricans* Gray, 1869, Proc. Zool. Soc. London, p. 195 (part).

*Damonia mutica* Boulenger, 1889, Cat. Chel. Brit. Mus., p. 96 (type listed from Canton).

*Clemmys schmackeri* Boettger, 1894, Ber. Senck. Ges., p. 129, Pl. III (type locality, probably Hainan).

*Clemmys nigricans* Siebenrock, 1903, Sitzber. Akad. Wiss. Wien (math.-natur.), CXII, Abt. I, p. 439 (Ningpo) (not of Gray, 1834); 1909, Zool. Jahrb., Suppl., X, p. 481 (part).

*Geoclemys mutica* Siebenrock, 1909, Zool. Jahrb., Suppl., X, p. 478.

*Clemmys mutica* Siebenrock, 1909, Ann. Naturh. Hofmus., Wien, XXIII, p. 312, Pls. XII and XIII (Formosa).

—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, pp. 404, fig. 4, and 469 (Hainan; Ningkwo, Anhwei).

*Description*.—Carapace tricarinate, lateral keels never well developed, often indistinct; first vertebral shield broader in front than behind; plastron about as long as carapace, truncate or broadly emarginate anteriorly, deeply notched posteriorly; sutures between abdominal and femoral shields about equal in length, only slightly longer than those between humerals and pectorals; anal suture generally a little shorter than gular; bridge distinct; upper jaw notched mesially; skin of head smooth. Head olive above, yellow below, a broad yellow band extending backward from eye over tympanum, its upper

<sup>1</sup>Reproduced herein as Plate III.

margin dark; carapace brown; plastron yellow, a large, black blotch on every shield (gulars rarely excepted), and two extra ones on each bridge.

Length of carapace.....	149 mm.
Width of carapace.....	108
Depth of shell.....	58

(Description based on Hainan series.)

The plastron in the male is slightly concave.

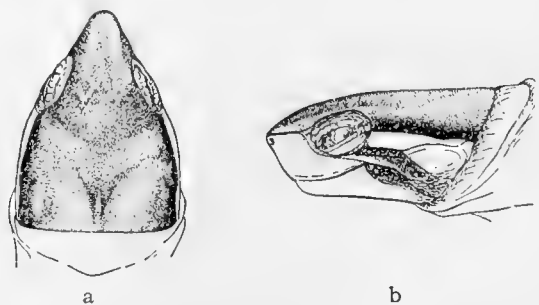


FIG. 8. *Clemmys mutica*. Nat. size. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 30170 from Hainan.

*Distribution*.—This rare species is known only from Kunshan in Kiangsu; Ningpo and Chusan, in Chekiang; Ningkwo, in Anhwei; Hainan; and Formosa.

*Habits and Habitat*.—*C. mutica* is apparently an aquatic species inhabiting low altitudes. It is common on Hainan about Nodoa.

*Material examined*.—I have seen the following specimens: 19 from Hainan, and 1 from Ningkwo, in the American Museum; the type and 3 examples from Formosa, in the British Museum; the type of *schmackeri*, in the Senckenbergisches Museum, Frankfort; and 1 specimen from Kunshan, in the Museum of Comparative Zoölogy.

### 13. *Clemmys nigricans* (Gray)

*Emys nigricans* Gray, 1834, Proc. Zool. Soc. London, p. 53 (type locality, Canton region); 1855, Cat. Sh. Rept. Brit. Mus., pt. 1, p. 20, Pl. VI (part).—Guenther, 1864, Rept. Brit. India, p. 26.

*Clemmys nigricans* Strauch, 1869, Mém. Acad. Imp. Sci. St. Pétersbourg, (7) V, No. 7, p. 32.

*Damonie nigricans* Gray, 1869, Proc. Zool. Soc. London, p. 195 (part).—Boulenger, 1889, Cat. Chel. Brit. Mus., p. 97.

*Description*.—This form may be distinguished from *mutica* by the fact that in *mutica* the chin and throat are uniform light yellow and entirely devoid of pattern, while in *nigricans* most of the throat is yellow with black mottling, and the chin, with some of the adjacent throat, has conspicuous black markings as follows: a thin V pointing forward just behind the mouth; a blotch on either side just behind this V; and a single median blotch just behind these two.

*Distribution*.—This species apparently inhabits southern China, probably Kwangtung.

*Material examined*.—I have seen the type and one other specimen, in the British Museum.

*Remarks*.—Only two specimens of this species are known.<sup>1</sup> Mell's (1922, p. 109) Kwangtung record proves to be based on an (at that time) undescribed form now known as *Geoclemys kwangtungensis*. See synonymy of *C. mutica* for further erroneous references to *nigricans*.

14. *Clemmys quadriocellata* Siebenrock

Figure 9

*Clemmys bealii quadriocellata* Siebenrock, 1903, Sitzber. Akad. Wiss. Wien (math.-natur.), CXII, Abt. I, p. 336, Pl. 1 (type locality, Phuc-Son, central Annam).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 145 (Lohsiang, Kwangsi).

*Clemmys bealii* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 403, fig. 3 (mountains south of Nodoo, Hainan) (not of Gray, 1831).—Fang, 1930, Sinensia, Nanking, I, p. 112, fig. 6 (Shihwantashan, Kwangsi) (not of Gray, 1831).

*Description*.—Carapace unicarinate, the keel poorly developed; first vertebral shield broader in front than behind; plastron shorter than carapace, truncate anteriorly, emarginate posteriorly; longest median suture between abdominal shields; gular and humeral sutures about equal, shorter than others; bridge distinct; upper jaw without mesial notch in young, feebly notched in adult; skin of head smooth. Head uniform olive or chocolate brown above, with two rounded, yellow areas (ocelli) longitudinally arranged on either side, the posterior ones larger and each with a single black spot in its center; yellow stripes on neck and throat; carapace dark brown with dark, radiating lines more or less evident on each shield; plastron yellow, profusely covered with small, dark spots, many of them elongate.

	Adult	Young
Length of carapace.....	129 mm.	58 mm.
Width of carapace.....	91	59
Depth of shell.....	46	25

(Description based on Hainan series.)

The yellow of the ocelli disappears with age.

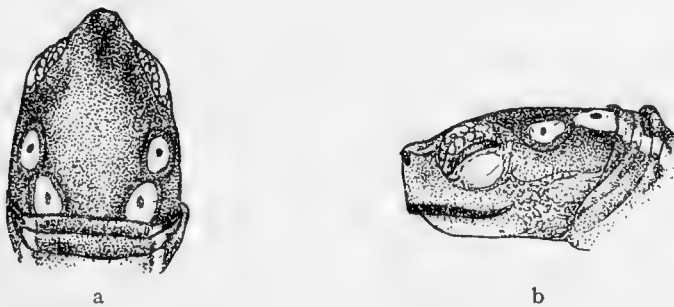


FIG. 9. *Clemmys quadriocellata*. x 2. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 28337 from the mountains south of Nodoo, Hainan.

A translation of the original description, based on the type specimen, follows:

Length of the carapace 63 mm., its breadth 63 mm., height of the shell 21 mm. Carapace as broad as long in the middle, narrower in front than behind; slightly tectiform with a vertebral keel; supracaudals notched in the middle, hind edge entire. Shields concentrically grooved on their edges. Vertebrals much broader than long and broader than the corresponding costals. Fifth vertebral strikingly small, only about half as broad as the third, which is the broadest. Nuchal moderately large, somewhat longer than broad and narrower in front than behind. Lateral marginals strongly projecting, second marginofemoral almost as broad as the third costal. Plastron narrower than the opening of the shell, truncated in front, notched behind. Anterior lobe narrower than the posterior lobe; the length of the latter exceeds the width of the bridge. The abdominal shields have a larger share in the formation of the bridge than the pectorals. Median anal suture longest, gular shortest; median femoral suture as long as the humeral and shorter than the abdominal; the latter scarcely longer than the pectoral. Axillary shields very small, the inguinal absent. Head small, edge of upper jaw entire, the width of the lower-jaw symphysis equals the diameter of the orbit. Webs large, extending to the claws. Length of tail somewhat less than half the shell-length.

Carapace blackish gray with a linear yellow margin. A suggestion of black radii on the edges of the discoidal shields. Plastron yellow, washed toward the middle with scanty brown radius-like stripes along the broad shield edges; only the gular and humeral shields remain plain yellow. A dark, cloudy stripe extends along the bridge. Head light brown above with two ocelli on each side of the occiput, of which the anterior is somewhat smaller than the posterior. Each ocellus consists of an intensely white spot, bordered by a yellow rim, in the middle of which lies a small black dot. Jaws dull yellow without markings. Neck and limbs nut brown above, dirty yellow below. Three longitudinal yellow stripes on the upper side of the neck, the median narrowest; the stripes more numerous below and laterally, but inconspicuous.

*Distribution*:—*C. quadriocellata* has been recorded from the following localities:

Annam: Phuc-Son.

Kwangtung: Lofaoshan; Hsiaokeng.

Hainan: mountains south of Nodoa.

Kwangsi: Lohsiang; Shihwantashan.

*Habits and Habitat*:—*C. quadriocellata* is an inhabitant of mountain streams, and probably prefers wooded regions. Mell (1922, p. 109) found it more numerous in southern than northern Kwangtung. He gives its vertical range as from 100-400 meters above sea-level.

This species lays only two eggs at a time (Mell, 1929, p. 192).

*Material examined*:—I have seen 5 specimens from Hainan in the American Museum.

*Remarks*:—There is every indication that the Kwangsi material so fully described and figured by Fang (1930, p. 112) and described by Fan (1931, p.

145) agrees with the Hainan series at hand. Mell's (1922, p. 109) Kwangtung specimens have not been so fully described, but Vogt (1922, p. 135) gives sufficient data to show that they too belong to true *quadriocellata*.

It is entirely possible that the present form will ultimately prove to be only a subspecies of *bealei* as hitherto considered, but until intergradation is demonstrated, it must be given full specific rank. Material from southern Fukien is greatly needed.

It might be well to remark that the head patterns of turtles are well known to be remarkably constant and therefore good characters for separation of species.

#### Genus *Geoclemys* Gray

*Geoclemys* Gray, 1855, Cat. Sh. Rept. Brit. Mus., pt. 1, p. 17.—Stejneger, 1907, Herp. Japan, p. 496 (*G. hamiltonii* fixed as type).

*Chinemys* Smith, 1931, Fauna Brit. India, p. 116 (type, *Emys reevesii*).

As understood here, this genus includes, in addition to the two species dealt with below, only *hamiltonii* of northern India.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- |                               |                               |
|-------------------------------|-------------------------------|
| I. Carapace tricarinate.....  | <i>reevesii</i> , p. 45       |
| II. Carapace unicarinate..... | <i>kwangtungensis</i> , p. 43 |

#### 15. *Geoclemys kwangtungensis* Pope

*Clemmys nigricans* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 109 (Lofaoshan, 300-400 meters; Tinghushan, 400 meters; and Hsiaokeng, 400 meters, three Kwangtung localities) (not of Gray, 1834); 1929, Beiträg. Fauna Sinica IV, p. 192 (breeding) (not of Gray, 1834).

*Geoclemys kwangtungensis* Pope, 1934, Amer. Mus. Novitates, No. 691, p. 1 (type locality, Lofaoshan, Kwangtung).

*Description*.—The original description of the type follows:

Head large, broad; snout pointed, projecting, its vertical profile oblique; edges of jaws not denticulate; upper jaw without hooks or median notch, its median, anterior profile concave; alveolar surface of both jaws very broad, without longitudinal ridges; bony choanæ immediately posterior to orbits; mandibular symphysis slightly longer than diameter of eye; anterior part of head covered by a large, smooth shield on crown and snout, another on each side covering the whole temporal area; posterior upper surface of head with granular skin; shell moderately depressed, slightly wider posteriorly than anteriorly; carapace with a strong median keel; nuchal shield small, elongate, narrowed anteriorly, emarginate posteriorly; first vertebral pentagonal, much broader in front than behind, just as broad as the fourth but broader than the second, third and fifth which are subequal in breadth; ninth marginal deepest, edges of third to eighth more or less turned up; posterior edge of carapace not serrated, almost smooth; plastron not concave, truncate in front, with a rounded notch behind; posterior lobe slightly broader than long, as broad as anterior, distinctly narrower than opening of shell; entoplastron intersected by humeropectoral suture; abdominal suture longest, as long as pectoral and humeral sutures taken together; humeral suture shortest, pectoral equal to femoral and anal barely shorter than gular; axillary scarcely half as large as inguinal; toes webbed to tips.

Carapace chestnut brown, without pattern, traces of yellow evident along its margins and median lateral angles; plastron yellow, irregularly marked with chestnut brown which is most conspicuous laterally, anteriorly and posteriorly; bridge chestnut brown; head uniform mahogany brown above, with fine, yellow vermiculations and a few irregular, narrow yellow stripes laterally; jaws and throat with dark spots and vermiculations; limbs and tail predominantly blackish, many of the shields on anterior aspect of forelimbs yellow and some yellow evident on the skin near the shell.

## MEASUREMENTS IN MILLIMETERS

Greatest length of carapace.....	142.5
Greatest width of carapace.....	100.5
Greatest length of plastron.....	124
Length of hind lobe of plastron.....	48
Width of hind lobe of plastron.....	56.5
Width of bridge.....	42
Depth of shell.....	59.5
Width of head.....	30
Diameter of eye.....	10
Length of tail from vent.....	32

The measurements of the carapace do not take into consideration its curve.

The shell is worn smooth so the type is undoubtedly quite mature.

*Distribution*.—This rare species is known only from Lofaoshan, Tinghushan and Hsiaokeng, all in Kwangtung.

*Habits and Habitat*.—Mell (1922, p. 109) found this turtle in mountain streams at altitudes of 300-400 meters. It lays only two eggs at a time (Mell, 1929, p. 192).

*Material examined*.—I have seen only the type (Berlin Museum No. 34955).

*Remarks*.—*G. kwangtungensis* is best described as a southern, mountain relative of *G. reevesii*. The two species may be readily distinguished by the following table:

<i>reevesii</i>	<i>kwangtungensis</i>
Alveolar surface of jaws moderately wide.	Alveolar surface of jaws very wide.
Median, anterior profile of upper jaw straight or straight with a weak notch.	Median, anterior profile of upper jaw concave.
Skin of posterior, dorsal surface of head divided into small, polygonal shields.	Skin of posterior, dorsal surface of head granular.
Carapace with three longitudinal keels.	Carapace with a single median keel.
Lower jaw and sides of head with conspicuous yellow lines and markings.	Lower jaw and sides of head with relatively inconspicuous and weak yellow lines and vermiculations.

The bony choanæ appear to be situated slightly more posteriorly in *kwangtungensis* but this character is variable and difficult to determine.



16. *Geoclemys reevesii* (Gray)

Figure 10

- Emys Reevesii* Gray, 1831, Synop. Rept., p. 73 (type locality, China).  
*Geoclemys Reevesii* Gray, 1855, Cat. Sh. Rept. Brit. Mus., pt. 1, p. 18, Pl. v.  
*Clemmys Reevesii* Fitzinger, 1861, Sitzber. Akad. Wiss. Wien (math.-natur.), XLII, p. 412.  
*Damonia reevesii* Gray, 1869, Proc. Zool. Soc. London, p. 194.  
*Damonia unicolor* Gray, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 78 (type locality, Shanghai).  
*Clemmys unicolor* Sclater, 1873, Proc. Zool. Soc. London, p. 517, Col. Pl. XLIV (type locality corrected to Ningpo, Chekiang).  
*Clemmys japonica* Sowerby, 1914, Fur Feather N. China, p. 166 (observed in Wei Ho valley of Shensi) (not of Temminck and Schlegel, 1835).  
*Geoclemys grangeri* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 1 (type locality, Yenchingkou, Szechwan).  
*Geoclemys paracaretta* Chang, 1929, Contr. Biol. Lab. Sci. Soc. China, V, No. 1, p. 1, fig. (type locality, Foochow).  
*Chinemys reevesi* Smith, 1931, Fauna Brit. India, Rept. Amphib., I, p. 117, Pl. II.

**Description:**—Carapace with three well-developed, persistent keels; first vertebral shield broader in front than behind; plastron almost as long as carapace, truncate or rounded anteriorly, notched posteriorly; median plastral sutures very variable but abdominal usually longest, sometimes no longer or even slightly shorter than pectoral or femoral; humeral shortest; bridge distinct; outline of upper jaw sinuous; skin of head divided into small shields posteriorly. Head dark brown or blackish, with broken, longitudinal yellow lines and elongate, curved or angular spots on the sides, and irregular yellow markings below; carapace dark brown, the median keel generally blackish; plastron with extremely variable combinations of dark brown to black mixed with yellow, the latter frequently confined to the margins and sutures.

The average measurements in millimeters of a series from Ningkwo follow (Schmidt, 1927, p. 471):

	13 ♂	15 ♀
Length of carapace.....	75	103
Width of carapace.....	53	72
Depth of shell.....	34	47
Length of plastron.....	64	92

These figures do not represent the maximum size attained by the species, because in an individual from Futsing Hsien the carapace measures 220 mm., and I have seen other specimens fully as large.

Lee (1925, p. 499) has given a general account of the soft anatomy of this turtle, and Rathouis (1878, Art. 14, p. 3) has described its axillary and inguinal scent glands.

**Distribution:**—The natural range of *reevesii* will never be known because it is for sale in markets throughout China and has thus been spread artificially. In order to clarify the matter as much as possible, I shall discuss its distribution as follows:

1. Occurrence in northern China.—Although long ago recorded from Tientsin by Moellendorff (1877, p. 103), Sowerby (1930, p. 25) doubts its presence in a wild state there. Jacot (1923, p. 260) omitted it from his list of Shantung reptiles, but I (1929, p. 364) have since recorded it from [the] Tsinan [region]. Mr. C. C. Liu writes me, however, that he failed to find it in a wild state in Shantung but saw it in the Taian market. Sowerby (1925, p. 44) gives Sanchieh, Anhwei, as the most northern locality at which he has observed *reevesii* but states elsewhere (1925, p. 498) that it reaches Honan, Shantung and southern Hopei. This statement lacks documentation and is obviously a generalization. Summarizing, it may be concluded that *reevesii* ranges northward at least throughout Kiangsu, Anhwei and much of Honan, probably reaching southern Shantung and Hopei.

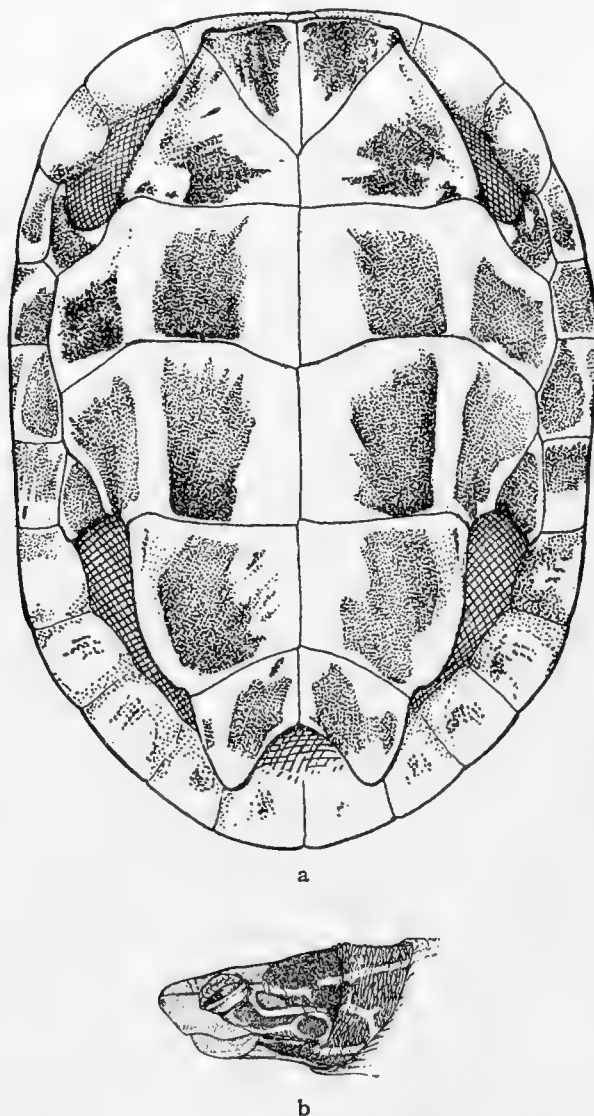


FIG. 10. *Geoclemys reevesii*. Nat. size. a. Ventral view of shell. b. Lateral view of head. A.M.N.H. No. 23481 from Yenchingkou, Szechwan.

There seem to be no concrete records for central China north of the Yangtze Valley, but turning to the northwest, there is evidence that *reevesii* reaches the Wei Valley of Shensi (Sowerby, 1930, l.c.). It has even been recorded from Pingliang, Kansu (Steindachner, 1896, p. 505).

2. Occurrence in western China.—In Szechwan, *reevesii* has been secured at Kwanhsien (Chang, 1932, p. 84) and Chengtu (Vogt, 1924, p. 337; and Chang, 1932, pp. 79, 82 and 84). There is a specimen in the U. S. National Museum from the region of Kiating and abundant material from Süchow, so the presence of *reevesii* in western Szechwan and the upper Yangtze, as far as the Min River, is well established.

Werner's (1924, p. 40) Yunnanfu record is the only evidence of *reevesii* in Yunnan, but the material on which this record is based might well have been purchased in a market.

3. Occurrence in southern China.—Mell (1922, p. 109) observed this turtle repeatedly in Kwangtung whence it was reported as early as 1878 by Müller (p. 642). However, the southern records seem to be confined to the coastal region, *reevesii* being conspicuously absent from the southern parts of Kiangsi, Hunan and Kweichow. Siebenrock's (1907, pp. 1759 and 1760) record for Kwangsi is not very convincing and it should be remembered that neither Fang (1930, p. 95) nor Fan (1931, No. 11) listed it from that province.

In conclusion, it may be stated that *reevesii* ranges through the Yangtze Valley, in the broadest sense of that term, from the junction of the Yangtze with the Min, eastward to the sea, and along the Chinese seaboard from northern Kiangsu or southern Shantung, at least as far south as Canton, but is absent on Hainan. It also reaches the Wei valley in Shensi. Korea must be included in its range, but, oddly enough, I have found no record of its presence on Formosa. On the other hand, it is known from southern Japan (Stejneger, 1907, p. 499).

The alleged presence of this turtle in regions to the south of China has long been on record as shown by Boettger (1888, p. 106), but de Rooij (1915), Taylor (1921), and Smith (1931) have not included it in the faunas of the East Indies, Philippine Islands or mainland Asia south of China, respectively. I have, however, seen specimens from the Philippines and an individual from Java in the Museum of Comparative Zoölogy. These regions certainly should not be considered within the natural range of *reevesii*. It would be interesting, nevertheless, to see it become well established anywhere south of China.

*Habits and Habitat*.—This turtle is extremely abundant in the lower Yangtze Valley. It frequents ponds but may be found in rivers and canals as well (Sowerby, 1925, p. 498). Though thoroughly aquatic, *reevesii* also ventures a short distance from water (Sowerby, 1925, l.c.; Chang and Fang, 1931, p. 284). Sowerby correlates its choice of an aquatic or terrestrial environment with temperature and season, while Chang and Fang state that it leaves the water during rains. I often saw specimens drop off logs into the water near Ningkwo, where *reevesii* is common (Schmidt, 1927, l.c.). Additional evidence of its aquatic habits is found in the frequent presence of

green algæ growing on the carapace, a condition that has given rise to the name "Lumao Kuei," or Green-haired Turtle (Gray, 1873, p. 148; Chang and Fang, 1931, l.c.).

Kreyenberg (1908, p. 4) observed specimens in a wild state feeding under water on "cabbage" (Kohlpflanze), while he fed captive individuals chiefly on raw pork, sometimes on plant food. According to Sowerby (1925, l.c.), *reevesii* takes hooks baited with shrimp or worms and will feed on fish in captivity.

During courtship, the males parade around the female in a tireless effort to rub their snouts against hers (Klingelhöffer, 1906, p. 23). The eggs are laid on land in late spring after mating. They are white and elongate (Sowerby, 1925, l.c.), and range in number from four to six (Kreyenberg, 1908, l.c.; Mell, 1929, p. 192). Pavloff (1926, p. 7) describes the eggs as yellowish and spheroid with an average diameter of 19 mm. and states that they are deposited in dry sand during the month of June.

A captive female *reevesii* was observed to increase in length from 68.5 to 109 mm. in a year and a half (Klingelhöffer, 1906, l.c.). Flower (1925, p. 921) records an individual that lived 23½ years in captivity.

*G. reevesii* is not only tranquil in captivity but quickly learns to come for food (Kreyenberg, 1908, l.c.). This hardiness and ability to become accustomed to the proximity of man is also reflected in its choice of habitat, for it may even abound within the walls of a large city (Chang and Fang, 1931, l.c.).

Schnee (1899, p. 320) has given a general account of this species in captivity.

*Remarks:*—Gray's *unicolor* has been repeatedly shown to be only a melanistic variety, not a true geographic form; Smith (1931, p. 118) has disposed of *paracaretta* Chang as a mere abnormality, and I am convinced that Schmidt's *grangeri* is based on variable characters not confined to any region. None of these names can be considered as representing a true subspecies and only *unicolor* is of any biological significance.

Sowerby (1925, p. 496) has given a good popular account of *reevesii* based largely on field experience.

#### Genus *Ocadia* Gray

*Ocadia* Gray, 1870, Suppl. Cat. Sh. Rept. Brit. Mus., pt. 1, p. 35 (type, *Emys sinensis*).

This genus is monotypic.

#### 17. *Ocadia sinensis* (Gray)

##### Figure 11

*Emys Sinensis* Gray, 1834, Proc. Zool. Soc. London, p. 53 (type locality, China).—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 23 (Shanghai and Soochow, Kiangsu; Hangchow, Chekiang; Fukien).

*Emys Bennettii* Gray, 1844, Cat. Tort. Croc. Amphib. Brit. Mus., p. 21 (type locality, North America?).

*Emys chinensis* Gray, 1870, Suppl. Cat. Sh. Rept. Brit. Mus., pt. 1, p. 28.

*Ocadia sinensis* Gray, 1870, Suppl. Cat. Sh. Rept. Brit. Mus., pt. 1, p. 35.—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 109 (mountains east of Shiuchow, Kwangtung).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 102 (Foochow).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 402, fig. 2 (Hainan).

**Description:**—Carapace tricarinate, the lateral keels discontinuous; first vertebral shield wider in front than behind; plastron truncate anteriorly, notched posteriorly; longest median suture between abdominal, shortest between humeral shields; bridge well developed; axillary and inguinal shields large; upper jaw notched; skin of head smooth; digits fully webbed. Head and neck dark olive with numerous narrow, longitudinal yellow lines for the most part on the sides and below; limbs with similar lines. Carapace dark brown; plastron yellow, a dark blotch on every shield and two extra ones on each bridge.

Length of carapace..... 196 mm.

Width of carapace..... 140

Depth of shell..... 79

(Description based on Hainan series.)

I have seen a Formosan example with a carapace 243 mm. long.

The tail of the female is shorter than that of the male (Stejneger, 1907, p. 491).



FIG. 11. *Ocadia sinensis*. Nat. size. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 30184 from Hainan.

**Distribution:**—In China, this turtle is known from Hainan and Kwangtung (east of Shiuchow).

Stanley has listed it from Fukien, Hangchow, Soochow and Shanghai but no one else has found it north of Fukien, so I think it best to await confirmation of Stanley's more northern records. Stejneger has also reported it from Fukien. His specimen was, however, secured at Foochow by Sowerby and may have actually come from elsewhere in the province.

*O. sinensis* is well known on Formosa. It has also been collected in Annam (Siebenrock, 1903, p. 334).

*Habits and Habitat*.—This turtle inhabits quiet water (Smith 1931, p. 119) of open country at low elevations. It is common on Formosa and Hainan but apparently rare on the mainland.

Smith (1923, p. 197) has given the best first-hand account of it as follows:

The flesh of this fresh-water tortoise is eaten by the Hainanese and the specimens mentioned above were bought in the [Hoihow] market. One was kept alive for some time; it fed entirely on vegetable matter, refusing all animal food. In April it laid three eggs; they were perfect ovals about 40 x 25 mm. in size, with the usual hard, calcareous shell.

*Material examined*.—I have seen the following Chinese material: 24 specimens from Nodoa, Hainan, in the American Museum; the type and 3 additional examples from Hainan, in the British Museum; and 1 labeled "Foochow," in the U. S. National Museum.

#### Genus *Pseudocadia* Lindholm

*Pseudocadia* Lindholm, 1932, Zool. Anz., XCVII, p. 31 (type, *P. anyangensis*).

This genus is monotypic.

#### 18. *Pseudocadia anyangensis* (Ping)

Figure 12

*Testudo anyangensis* Ping, 1930, Bull. Fan Mem. Inst. Biol., I, p. 217 (type locality, ancient ruins in Anyang Hsien, Honan).

*Pseudocadia anyangensis* Lindholm, 1932, Zool. Anz., XCVII, p. 30.

*Description*.—The original description, based on the unique type, follows:

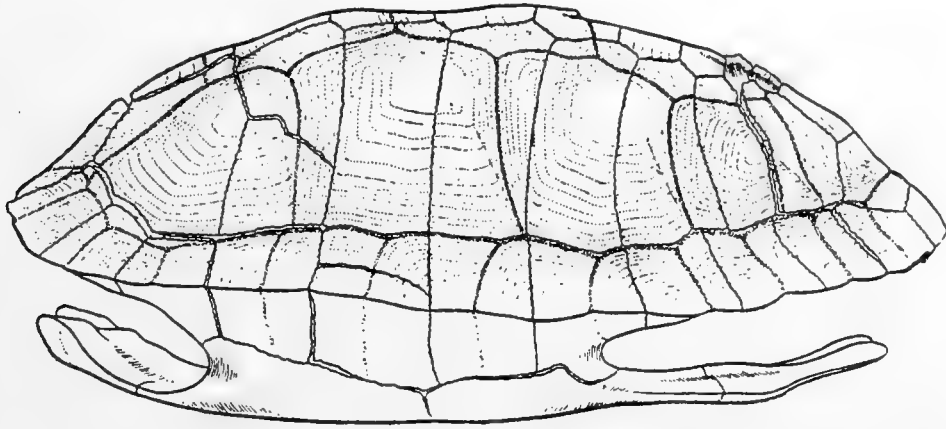
Shell very highly convex dorsally. Margin of the carapace smooth. Plastron somewhat concave along the region of its median line and gently convex on its lateral portions. Nuchal plate large, hexagonal, with anterior margins slightly concave, longer than any of the other margins, antero- and postero-lateral almost straight, the former slightly larger than the latter, posterior concave, shortest. First neural plate tetragonal, longer than broad, all margins convex, lateral margin longest, and posterior margin longer than anterior. From second neural plate to eighth inclusive, each one hexagonal. Second and third neural plate each with its anterior margin slightly concave, posterior slightly convex, and antero- and postero-lateral straight. Fourth with its anterior margin slightly concave, all the rest of its margins almost straight. Fifth with all margins straight, and a little trace of short keel along its median line. Sixth with its anterior, antero- and postero-lateral margins almost straight, and posterior slightly concave. Seventh with its anterior margin slightly convex and posteriorly slightly concave, all the other margins almost straight. A blunt keel along its median line which probably extends to the following plate. Eighth missing, its outline showing its anterior margin slightly convex, postero-lateral slightly concave and antero-lateral and posterior almost straight. Greatest width of each of the above

mentioned seven plates either equal to, or greater than, its greatest length. First suprapygals with anterior margin straight, antero- and postero-lateral almost forming a straight line and each slightly convex, posterior slightly convex, and longer than anterior, its greatest length slightly greater than greatest width. Second suprapygals hexagonal, anterior margin slightly concave, antero- and postero-lateral straight and latter slightly longer than former, posterior concave, longer than anterior, width much greater than length. Pygal somewhat rectangular in outline, anterior margin convex, lateral straight and posterior almost straight with a notch at its middle, wider than long. The costal plates have their lateral margins coincide with those of the costal shields, but that of the anterior portion of the first one does not reach the anterior margin of the first costal scute. First costal plate somewhat septagonal, its medial and each of the three sections constituting the anterior margin concave or slightly so, while posterior and lateral convex or slightly so, medial extremity much longer than lateral, posterior margin longest, and postero-lateral straight and shortest. Second to eighth inclusive all pentagonal in outline. Medial extremity of each of them shorter than lateral. Anterior margin of second and third concave, of fourth and fifth straight and of sixth, seventh and eighth convex or slightly so. Posterior margin of second plate convex, of third and fourth straight, of fifth, sixth and seventh concave. Lateral margins of them straight or slightly convex, except those of second and sixth which are slightly concave. Antero- and postero-medials of second to seventh plates inclusive all straight, the former much longer than latter. Eighth costal plate shorter than any of the preceding plates. Anterior margin, antero-medial and lateral slightly convex, postero-medial slightly concave, and posterior straight. The first marginal plate with its peripheral margin much longer than central, and medial longer than lateral, all margins almost straight. Its anterior margin is thinly edged and the plate becoming thickened posteriorly. Second marginal plate in almost similar case except the peripheral margin slightly convex. Third with the peripheral margin of its dorsal surface longer than central, the former slightly convex and the latter slightly concave, and the other two margins straight. Its ventral portion constituting the anterior end of the bridge that unites the carapace and the plastron. Fourth, fifth and sixth somewhat similar in shape and size, their dorsal portions all more or less rectangular in outline with somewhat straight margins and their ventral portions convex, constituting the main part of the bridge. Seventh with dorsal portion rectanguloid in outline and all margins somewhat straight except a gentle concavity on its peripheral margin which is longer than central. Its ventral portion gradually thinned posteriorly and its anterior thick portion constituting the posterior end of the bridge. Eighth, ninth and tenth all tetragonal, the former one with its peripheral margins longer than central, while each of the latter two with peripheral margin almost equal to central, and all margins almost straight. Eleventh pentagonal, only its peripheral margin slightly convex, all the rest margins straight. The last four marginal plates all comparatively thinly edged and becoming gradually thickened centrally. The bony plates of the plastron are quite clear. Epiplastron somewhat pentagonal, its peripheral margin consisting of two sections of which the medial one is convex and comparatively thick and the lateral one is only slightly convex and thinner but longer than the medial, the central margin slightly concave, and other two margins straight. Endoplastron somewhat trianguloid, with all margins convex and the angles blunt, wider than long. Hyoplastron with anterior margin oblique and straight and antero-medial concave. Anterior third of its lateral margin free, of which the anterior half convex and posterior half concave. The free edge is rounded and comparatively thick. The rest of its lateral portion extending latero-dorsally, forming axillary process (buttress) and the antero-ventral part of the bridge, medial about straight, posterior slightly convex. Hypoplastron about

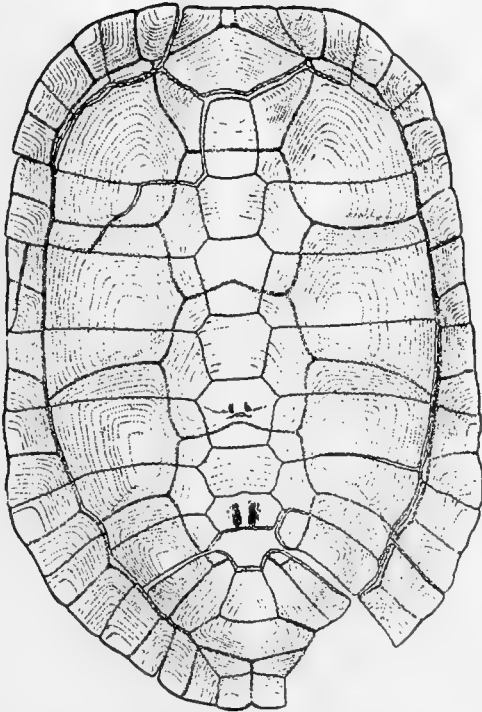
equal to hyoplastron in size or slightly longer. Its anterior and posterior margins slightly concave, medial not quite straight. Anterior half of its lateral portion extending latero-dorsally, forming the postero-ventral part of the bridge and inguinal process (buttress) and posterior half of the lateral portion forming a smooth, gently convex margin. Average length of either hyoplastron or hypoplastron about equal to its average width. Xyphiplastron with anterior margin slightly convex, medial about straight, posterior concave and lateral margin in two sections each of which is convex especially the anterior one. The anterior margin is more than twice the posterior in length. The horny shields of the carapace could be readily made out. Nuchal scute small, rectangular in outline, longer than wide, its anterior margin shorter than posterior, and all margins slightly concave. All the vertebral scutes large and hexagonal. First vertebral scute with its anterior and antero-lateral margins slightly concave, postero-lateral slightly convex and posterior straight. Anterior margin shortest, postero-lateral longer than antero-lateral. Second, third and fourth vertebral scutes all similar in shape and size, except that the anterior margin of the second is straight and different from these of the following two which are convex. All the other margins of each of them similar to the corresponding ones of the other. Each of the antero-lateral margins of them slightly convex at its anterior half and then concave at its posterior half, and each of postero-lateral margins slightly concave at its anterior half and convex at its posterior half. Fifth vertebral scute not perfectly preserved, but as far as we can make out from the specimen this scute appears to be septagonal, its antero- and postero-lateral margins straight. There are four costal scutes. The last one is the smallest. First costal scute irregularly hexagonal and its posterior margin longest. Second and third similar to each other in outline, the former is larger than the latter. They are pentagonal. The anterior and posterior margins of the second concave, its lateral margin slightly convex or about straight and its antero- and postero-medial convex near the anterior posterior angles respectively and concave toward the middle angle where they meet each other. Third with its anterior margin convex and posterior concave and other margins similar to those corresponding ones of the second. Fourth different from either second or third by its smaller size, it also pentagonal in outline. Its anterior margin convex, antero- and postero-lateral concave, medial slightly concave and posterior straight. The areola in each of the costal scutes quite large, situated at its postero-medial portion. There are about eleven lines of growth which are very distinct on its lateral side. There are twelve marginal scutes, except the first one which has its medial margin very short and is irregularly tetragonal, all the scutes more or less rectangular in outline, the twelfth one being the smallest. Some of the areola quite distinct situated at postero-lateral portion of the scute and about eleven lines of growth could be traced from it to the medial margin. The horny shields of the plastron all distinct. Gular scute small, somewhat wedge-shaped, its central apex just meeting the apex of the endoplastron. Humero-pectoral sulcus almost straight, traversing the middle of the endoplastron. The antero- and postero-medial margins of the humeral scute slightly concave, antero-lateral convex, and postero-lateral straight, its size almost twice that of the gular. Pectoral scute much larger than gular and humeral taken together, its anterior and medial margins straight, and posterior concave. Its lateral portion expanded slightly dorsally. The sulcus between itself and axillary scute not distinct in this specimen. Abdominal scute somewhat larger than pectoral, its medial margin not quite straight, anterior convex and posterior concave, lateral portion expanded slightly dorsally, with the sulcus between itself and inguinal scute concave forming its short postero-lateral margin. Femoral somewhat quadrangular, smaller than either pectoral or abdominal. Its medial margin straight, lateral and anterior convex, and posterior concave. Anal smaller than femoral, about equal to or slightly larger than humeral,



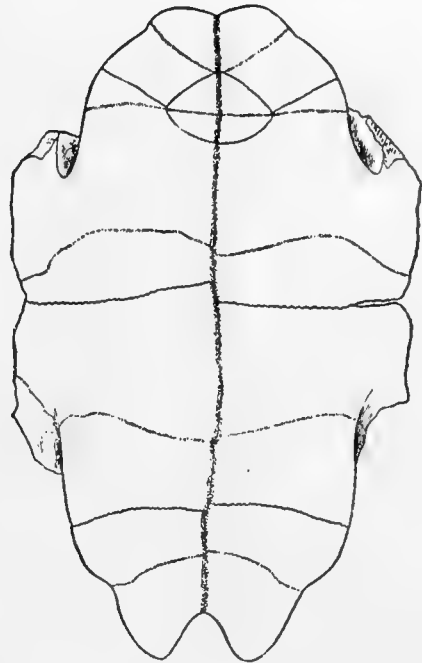
quadrangular, medial margin straight, lateral and anterior gently convex and posterior concave. Both axillary and inguinal scutes are narrow and long. Length of the carapace along its median line (in straight line) 247 mm.; length of the plastron along its median line (in straight line) 215 mm.; width of the shell across its middle (in straight line) 164 mm.; height of the shell at its middle (in straight line) 97 mm.



a



b



c

FIG. 12. *Pseudocadia anyangensis*. Type. a. Lateral view of shell,  $\times \frac{1}{2}$ . b. Dorsal view of carapace,  $\times \frac{1}{4}$ . c. Ventral view of plastron,  $\times \frac{1}{4}$ . (From Ping.)

*Distribution*.—This apparently extinct species is known only from a single shell found in the ancient ruins of Anyang Hsien, Honan, by the Excavation Party of the Central Ministry of Research. According to Ping it is impossible to say whether the shell originally came from Anyang Hsien or was brought there during the Shang Dynasty (about 1500 B. C.).

*Remarks*.—Lindholm (1932, p. 27) has very rightly stated that *anyangensis* is not a testudinine but an emydine form distinct enough to be made the type of a new genus allied to *Ocadia* but differing from all recent turtles of the subfamily Emydinæ by the failure of its gularohumeral suture to intersect the entoplastron, a condition clearly shown in the illustration of its plastron. From *Ocadia* it further differs in the shape of the entoplastron which is much broader than long instead of longer than broad. Another point worthy of note but not mentioned by Lindholm is the fact that, in *Pseudocadia*, the entoplastron is crossed at its broadest point by the humeropectoral suture, while in *Ocadia* this suture crosses distinctly posterior to the broadest point of the entoplastron. When more material of *anyangensis* becomes available, additional characters distinguishing it from *Ocadia sinensis* as well as other Chinese turtles will doubtless be evident, but for the present, the characters already cited should suffice.

#### Genus *Testudo* Linnæus

Species of this, the largest genus of chelonians, occur in the New World, Africa, southern Europe, western and southern Asia, the Malay Archipelago and certain islands. Lindholm (1929, p. 284) has indicated fifteen species, each as the type of a subgenus.

Two species, *T. platynota* Blyth and *T. impressa* (Guenther), although not recorded from China, closely approach its limits, the former in Upper Burma (Anderson, 1879, p. 712), the latter in Tongking and northern Siam (Smith, 1931, p. 145). An additional form, *T. emys* Schlegel and Müller, was reported from the mouth of the Yangtze by Siebenrock (1906, p. 583) and bought in a Canton market by Mell (1922, p. 108), but this turtle certainly does not occur on the lower Yangtze delta, while Mell's record is obviously open to doubt. The following key will serve to distinguish these three species from one another or from *elongata*:

#### KEY FOR IDENTIFICATION OF SPECIES

##### I. A single supracaudal shield

- A. Carapace black, each shield with a yellow center from which yellow lines radiate; entoplastron anterior to humeropectoral suture; nuchal shield absent. . . . . *platynota*, p. 54
- B. Carapace yellow, each shield with a black center; entoplastron intersected by humeropectoral suture; nuchal shield rarely absent. . . . . *elongata*, p. 55

II. Two supracaudal shields; entoplastron anterior to humeropectoral suture; nuchal shield present

A. Vertebral shields more or less convex in adults; pectoral shields usually widely separated from one another; carapace dark horn or blackish. . . . .

*emys*, p. 54

B. Vertebral shields flat or concave; pectoral shields in contact with one another; carapace variegated chestnut, the shields usually with light margins. . . . .

*impressa*, p. 54

### 19. *Testudo elongata* Blyth

#### Figure 13

*Testudo elongata* Blyth, 1853, Journ. Asiat. Soc. Bengal, XXII, p. 639 (type locality, Arakan).—Fang, 1930, Sinensia, Nanking, I, p. 103, figs. 3-4 (living examples purchased from a village near Nanning, Kwangsi).

*Description*.—Forelimb with five claws; supracaudal shield single; nuchal shield rarely absent; entoplastron intersected by humeropectoral suture; upper jaw tricuspid; carapace and plastron yellow with black centers to shields.

The dimensions of the Kwangsi specimen described by Fang (1930, p. 106) are as follows:

Length of carapace. . . . .	223 mm.
Width of carapace. . . . .	140
Depth of shell. . . . .	105

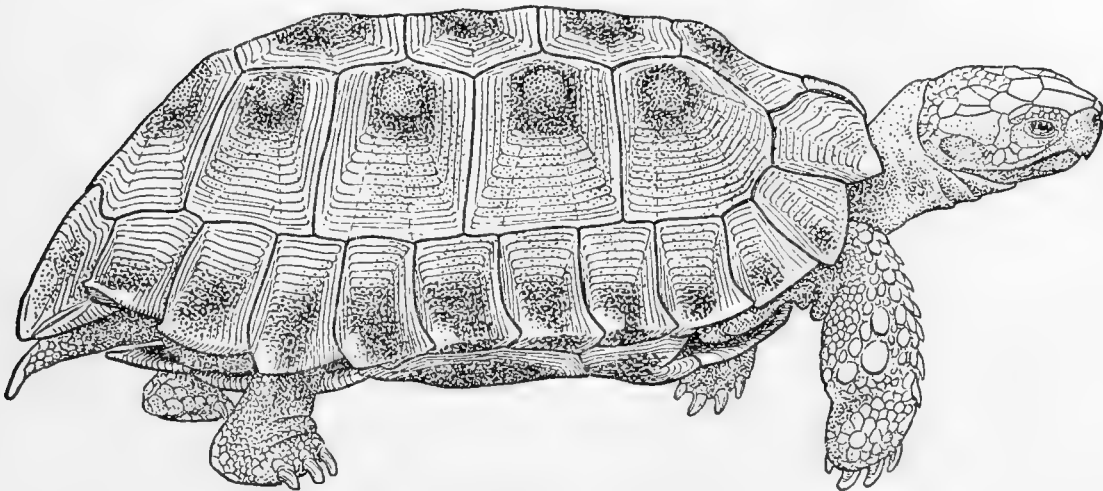


FIG. 13. *Testudo elongata* (from Smith).

*Distribution*.—Fang's example from near Nanning, Kwangsi, introduced this species into the Chinese fauna. Its presence at Bhamo (Boulenger, 1888, p. 593), as well as near Nanning, means that it is to be expected in southern Yunnan. Southward, it ranges into the Malay Peninsula as far as Penang. It has been recorded from Tongking.

*Habits and Habitat*.—Smith (1931, p. 143) states that this tortoise inhabits hilly country at low altitudes and has great capacity for withstanding heat.

In captivity, *elongata* prefers a diet of bananas (Flower, 1899, p. 617).

*Remarks*.—This species was not recorded from Yunnan by Anderson as stated by Fang. Smith regards Annandale's *T. parallela* as a synonym of *elongata*.

Lindholm (1929, p. 285) has made *elongata* the type of a new subgenus, *Indotestudo*.

#### Family TRIONYCHIDÆ

The soft-shelled or mud-turtles are represented in China by only two genera.

Gray's (1873, p. 78) record of *Amyda gangetica* for China is obviously an error, the range of this species not even approaching the limits of China (Smith, 1931, p. 168). It should be noted that Boulenger (1889, p. 248) did not record this alleged Chinese specimen of Gray.

#### KEY FOR IDENTIFICATION OF CHINESE GENERA

- I. Orbit nearer to temporal than to nasal fossa; postorbital arch narrower than diameter of orbit; proboscis as long as diameter of orbit. *Amyda*, p. 58
- II. Orbit nearer to nasal than to temporal fossa; postorbital arch somewhat broader than diameter of orbit; proboscis very short, not more than half as long as diameter of orbit. . . . . *Pelochelys*, p. 56

#### Genus *Pelochelys* Gray

*Pelochelys* Gray, 1864, Proc. Zool. Soc. London, p. 89.—Guenther, 1865, Zool. Rec., 1864, Rept., p. 108 (*P. cantorii* named as type).

This is a monotypic genus.

#### 20. *Pelochelys bibroni* (Owen)

##### Figure 14

*Trionyx* (*Gymnopus*) *Bibroni* Owen, 1853, Descr. Cat. Osteol. Ser. R. Col. Surg., I, p. 185 (type locality, Australia).

*Chitra indica* Guenther, 1864, Rept. Brit. India, p. 50 (part).

*Pelochelys cantorii* Gray, 1864, Proc. Zool. Soc. London, p. 90, figs. 9-10 (type locality, Malacca).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 409, figs. 7-8 (Nodoa region, Hainan).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 365 (Foochow).

*Pelochelys cantoris* Boulenger, 1889, Cat. Chel. Brit. Mus., p. 263, fig. 69; 1891, Ann. Mag. Nat. Hist., (6) VII, p. 283.

*Pelochelys Poljakowii* Strauch, 1890, Mém. Acad. Imp. Sci. St. Pétersbourg, (7) XXXVIII, No. 2, p. 118, Pl. IV (type locality, Foochow).

*Pelochelys bibroni* Smith, 1930, Bull. Raffles Mus., Singapore, No. 3, p. 3.

*Description*.—Entoplastron forming an acute angle; head broad, rounded anteriorly; proboscis short, a mere stump; neck without tubercles; anterior border of dorsal disc not clearly defined, not folded; dorsal disc devoid of

tubercles, pitted over neurals and costals. Uniform dark olive above, light below; inconspicuous dark dots on upper surface of head.

Length of dorsal disc (following curve)..... 258 and 245 mm.

Width of dorsal disc (following curve)..... 230 and 225

(Description based on two Foochow examples.)

*P. bibroni* attains an enormous size. De Rooij (1915, p. 331) gives the dimensions of the dorsal disc as 1290 x 740 mm., and Mell (1922, p. 110) saw one in Kwangtung with a 720 mm. disc. A Hainan specimen with a disc measuring 560 mm. weighed 42 pounds, and local fishermen declared that this weight represents only one third of the maximum for the island.

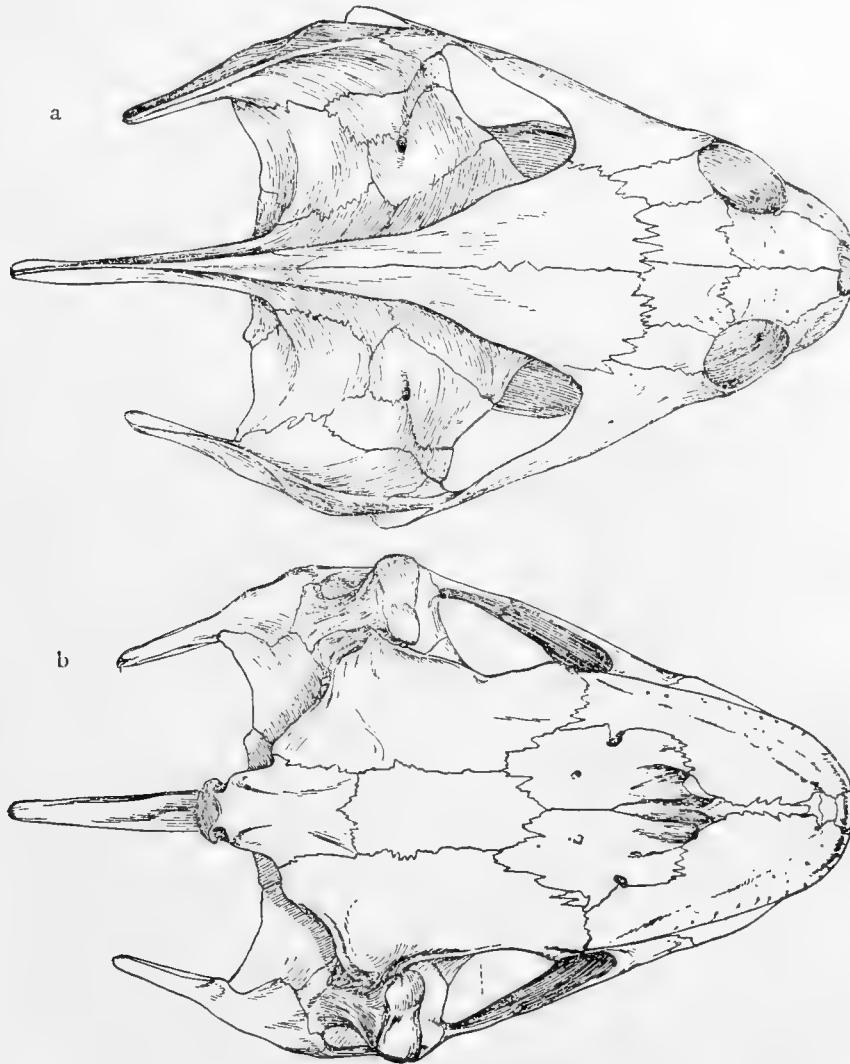


FIG. 14. Skull of *Pelochelys bibroni*. Nat. size. a. Dorsal view. b. Ventral view. A.M.N.H. No. 28342 from Hainan.

*Distribution*.—In China, *P. bibroni* has been secured in the region of Nodoa, Hainan; and at Foochow. Mell repeatedly observed it for sale in Canton.

Distributed from southern China and Burma southward through the Malay Archipelago to the Philippines and New Guinea. Its occurrence in Bengal is doubtful (Smith, 1931, p. 161).

*Habits and Habitat*.—After continued observations in the field, Smith (1930, p. 3, and 1931, l.c.) concluded that, in Siam, this species inhabits deep, sluggish rivers above the limits of salt water. Mell (1929, p. 192) writes of *bibroni* as a salt-water turtle, while de Rooij (1915, p. 332) states that it is "often caught on the sea-coast," and Smedley (1932, p. 12) gives a definite record of one taken in the sea. Smith's conclusion, however, is confirmed by the presence of *bibroni* far inland on Hainan near Nodoa (Schmidt, 1927, p. 409). There it was not found in rivers but in small streams.

According to Mell (1929, p. 191), *bibroni* may lay as many as 27 eggs in a single clutch but the full complement is not deposited at one time.

A specimen of *bibroni* kept in the Manila aquarium fed on small, dead fish but would not eat living ones (Taylor, 1921, p. 188).

Mell (1929, p. 192) refers to the sluggishness of this large turtle, and I observed that the Hainan specimens were very inactive. When repeatedly annoyed, they struck without warning and with great speed but produced no noticeable effect, a behavior similar to that of some snakes which coil and strike but do not open the mouth when doing so. I saw a Hainan fisherman struck on the hand by a large specimen (dorsal disc at least 475 mm.) without suffering any injury whatsoever.

*Material examined*.—I have seen only 4 Chinese specimens, 2 from Hainan and 2 from Foochow, all in the American Museum and all collected by myself.

*Remarks*.—Since *bibroni* does not reach Australia, Owen's type locality is obviously erroneous.

A study of Fang's (1930, p. 131) description and figures of the material from Lingyun Hsien, Kwangsi, identified by him as *bibroni*, will show that the specimens in question actually represent *Amyda sinensis*.

#### Genus *Amyda* Oken

*Amyda* Oken, 1816, Lehrb. Zool., II, p. 348 (type, *Trionyx euphraticus*).

Although most of the species of this genus are Asiatic and Malayan, several occur in North America and one in Africa.

*A. formosa* (Gray) has long been known from the Bhamo region (Anderson,

1879, p. 786; Boulenger, 1888, p. 594, and Annandale, 1912, p. 167) where it closely approaches the borders of Yunnan.

## KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Dorsal disc bordered anteriorly by a row of large tubercles; a conspicuous patch of tubercles on each side of base of neck. . . . . *steindachneri*, p. 63
- II. Dorsal disc not bordered anteriorly by a row of large tubercles; no conspicuous patch of tubercles on either side of base of neck. . . . . *sinensis*, p. 59

Smith (1931, p. 167) has used an alleged difference in the length of the mandibular symphysis relative to that of the diameter of the eye as a key character separating *steindachneri* from *sinensis*, but I fail to find that such a difference exists. After the characters given in the foregoing key, the pattern of the head and neck of *steindachneri* stands next as a means of distinguishing the two species.

21. *Amyda sinensis* (Wiegmann)

## Plate II, D, and Figure 15

- Trionyx (Aspidonectes) sinensis* Wiegmann, 1835, Nova Acta Acad. Leop. Carol., XVII, p. 189 (type locality, a small island in the Tiger River near Macao).
- Pelodiscus sinensis* Fitzinger, 1835, Ann. Wien Mus., I, p. 127.
- Trionyx tuberculatus* Cantor, 1842, Ann. Mag. Nat. Hist., IX, p. 482 (type locality, Chusan Island).
- Tyrse perocellata* Gray, 1844, Cat. Tort. Croc. Amphib. Brit. Mus., p. 48 (type locality, Canton).
- Trionyx perocellatus* Gray, 1855, Cat. Sh. Rept. Brit. Mus., pt. 1, p. 65, Pl. xxxi.
- Trionyx Schlegelii* Brandt, 1857, Mém. Biol. Acad. Sci. St. Pétersbourg, II, p. 610 (type locality, Peiping).
- Dogania subplana* Gray, 1862, Proc. Zool. Soc. London, p. 265 (China and Formosa) (not of Geoffroy, 1809).
- Potamochelys? perocellatus* Gray, 1864, Proc. Zool. Soc. London, p. 86.
- Trionyx subplanus* Strauch, 1865, Mém. Acad. Imp. Sci. St. Pétersbourg, (7) VIII, No. 13, p. 130 (part: China and Formosa).
- Landemania irrorata* Gray, 1869, Proc. Zool. Soc. London, p. 216, fig. 18 (type locality, Shanghai).
- Landemania? perocellata* Gray, 1869, Proc. Zool. Soc. London, p. 216.
- Gymnopus perocellatus* David, 1872, Nouv. Arch. Mus. Hist. Nat., Paris, VIII, Bull., p. 37 (Hwang Ho in Suiyuan; and Peiping).
- Oscaria Swinhoei* Gray, 1873, Ann. Mag. Nat. Hist., (4) XII, p. 157, Pl. v (type locality, Shanghai).
- Gymnopus simonii* David, 1875, Journ. Trois. Voy. Chinois, II, p. 214 (Kiangsi) (nomen nudum).
- Yuen leprosus* Heude, 1880, Mém. Hist. Nat. Emp. Chinois, I, p. 20 (type locality, Hwangpu at Shanghai).
- Yuen maculatus* Heude, 1880, p. 22, Pls. 1 and 1a (type locality, Hwangpu).
- Yuen elegans* Heude, 1880, p. 23 (type locality, Hwangpu).
- Yuen viridis* Heude, 1880, l.c. (type locality, Taihu, Kiangsu).
- Yuen pallens* Heude, 1880, l.c. (type locality, Taihu, Kiangsu).
- Psilognathus lavis* Heude, 1880, p. 24, Pl. II (type locality, streams of the mountainous region south of Ningkwo, Anhwei).
- Temnognathus mordax* Heude, 1880, p. 26, Pl. III (type locality, environs of Shanghai).
- Gomphopelta officinae* Heude, 1880, p. 27, Pl. IV (type locality, Hwai Ho where it flows out of Honan).
- Coelognathus novem-costatus* Heude, 1880, p. 29, Pl. v (type locality, eastern extremity of Chao Hu, Anhwei).
- Tortisternum novem-costatum* Heude, 1880, p. 31, Pl. vi (type locality, Chao Hu, Anhwei).
- Ceramopelta latirostris* Heude, 1880, p. 33, Pl. vii (type locality, environs of Nanking).
- Coptopelta septem-costata* Heude, 1880, p. 35, Pl. viii (type locality, lakes of Tungliu, Anhwei).
- Cinctisternum binctum* Heude, 1880, p. 37, Pl. ix (type locality, marsh of Nanking).
- Trionyx swinhonis* Boulenger, 1889, Cat. Chel. Brit. Mus., p. 257.
- Trionyx cartilagineus* var. *newtoni* Bethencourt Ferreira, 1897, Jorn. Sci. Lisboa, (2) V, p. 114 (type locality, Timor).

- Tryonix sinensis newtoni* Bethencourt Ferreira, 1898, Journ. Sci. Lisboa, (2) V, p. 151.  
*Trionyx sinensis* Schnee, 1898, Natur Haus, VI, p. 113, figs. (habits); 1899, Zeitschr. Naturw., LXXII, p. 202 (habits).  
*Amyda sinensis* Stejneger, 1907, Herp. Japan, p. 524.—Kreyenberg, 1910, Blätt. Aquar. Terr. Kunde, XXI, p. 7 (habits and distribution).  
*Amyda schlegelii* Stejneger, 1907, Herp. Japan, p. 526, figs. 407-409.  
*Trionyx swinhoei* Siebenrock, 1909, Zool. Jahrb., Suppl., X, p. 602.  
*Trionyx maackii* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 23 (Shanghai) (erroneous spelling of *maackii*; not of Brandt, 1857).  
*Trionyx sinensis cyphus* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 136 (described as a monstrosity).  
*Amyda* sp. Jacot, 1923, China Journ. Sci. Arts, I, p. 260 (Tsinan region, Shantung).  
*Amyda tuberculata* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 473 (Changsha and Yochow, Hunan; Hsinglungshan and Peiping market, Hopei; Chungchow, Szechwan; Yenping, Fukien; Ningkwo, Anhwei; Niantzekwan and Chintzu, Shansi; Paotowchen, Suiyuan).—Mell, 1929, Beiträg. Fauna Sinica IV, p. 3 etc. (behavior and distribution).  
*Pelochelys cantorii* Fang, 1930, Sinensia, Nanking, I, p. 131, fig. 10 (Lingyun Hsien, Kwangsi) (not of Gray, 1864).  
*Trionyx sinensis* (forma typica) Smith, 1931, Fauna Brit. India, Rept. Amphib., I, p. 176, fig. 41.  
*Trionyx sinensis tuberculatus* Smith, 1931, Fauna Brit. India, Rept. Amphib., I, p. 178.  
*Amyda* sp. (*tuberculata* subsp.?) Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 149 (Mong-kong and Lohsiang, Kwangsi).

*Description*.—Entoplastron forming an obtuse angle; head narrow or moderately broad, pointed anteriorly; proboscis long; neck without distinct tubercles; anterior border of dorsal disc clearly defined, folded; dorsal disc smooth or with numerous tubercles, more or less pitted over neurals and costals. Coloration extremely variable but generally olive above with or without vermiculations, light yellowish below; large, dark ventral and small, black dorsal spots usually evident in juveniles, sometimes persistent to early maturity; head with or without fine black lines radiating from eyes; throat light or vermiculated, or dark with yellowish spots.

Rathouis (1878, Art. 14) has described and illustrated the scent glands of *sinensis*. There are three of these on each side, two lateral and one anterior.

*Distribution*.—This turtle is universally distributed along the seaboard of eastern Asia from Changnam Province, Annam, and Hainan in the south, to Hopei and Jehol in the north. Beyond this it is replaced by *maackii* if, indeed, that form be distinct. From the seaboard the range of *sinensis* extends westward in China as far as indicated by the following selected localities:

- Suiyuan: Paotowchen (taken from Hwang Ho); Hwang Ho between 110° E. Long. and 40° N. Lat. (Przewalski, collector).  
 Shensi: Lo Ho between Fuchow and Kanchuan; 30 miles south and 12 miles east of Yen-an; Sian region.  
 Kansu: Sanshihlipu; Kingyang; river of Hweih sien.  
 Szechwan: Chungchungchou; Chengtu; Kiating.  
 Yunnan: Tungchwan; Yunnanfu.  
 Kweichow: Kweiyang.  
 Kwangsi: Lingyun Hsien; Nanning.



There are scattered and highly questionable records of this species for Singapore, Siam, the Batan Islands and even California (*Aspidonectes californiana* Rivers, see Van Denburgh, 1917, p. 33) but these are of little importance and do not indicate that *sinensis* has become established in any of these regions. It has doubtless been carried far and wide on boats. De Rooij (1915, p. 330), however, includes it in the fauna of the Malay Archipelago on the strength of Bethencourt Ferreira's record for Timor given in the synonymy (*newtoni*). It certainly occurs on Formosa, and I doubt very



FIG. 15. *Amyda sinensis*. Ventral view of juvenile. (From Smith.)

much if the alleged Japanese and Manchurian forms are distinct, but cannot place them in synonymy because I lack comparative material to form the basis of careful collation.

*Habits and Habitat*.—*A. sinensis* is generally abundant in the rivers, lakes, canals and creeks of China, but does not ascend into the cascading streams about Sanchiang and Kuatun, for the people there were entirely unfamiliar with turtles of all kinds (Pope, 1929, p. 364). This probably means that *sinensis* is scarcely to be expected in certain other regions of high, precipitous mountains. However, its occurrence at Paotowchen, Chengtu, Yunnanfu,

Tungchwan, Kweiyang, etc., proves that it reaches considerable altitudes in northern and western China.

Although scores of pages have been devoted to descriptions of *sinensis*, very little that would serve to distinguish it from any other species of the genus has been written on its habits (see synonymy).

According to Heude (1880, pp. 14-15, 31, 32, 33 and 37), *sinensis* is both carnivorous and herbivorous. He detected remains of fish, crustaceans, mollusks, insects and seeds of marsh plants in the numerous stomachs that he examined. More specifically, he found abundant remnants of grasshoppers, bivalves (*Modiola* and *Corbicula*) and seeds of the marsh plant *Euryale ferox*; rarely, remains of bivalves of the genus *Unio* and of a gastropod (*Paludina*). A catfish spine was discovered once.

Licent (1932, p. 35) reported the discovery of quantities of eggs on June 14, 1920, in northeastern Kansu. This gives some idea of the breeding season in that part of China. At the same time he recorded eggs of *A. maackii* found near Kirin on June 29, 1928.

Mitsukuri (1895, p. 143, and 1905, p. 257) has given excellent accounts of the artificial propagation of *Amyda japonica* in Japanese turtle-farms, and since *japonica* is very closely allied to if not identical with *sinensis*, their habits are probably similar.

*Material examined*.—I have seen the following specimens from China: 2 from the Canton market and 1 (No. 34256) from Kwangtung, in the Berlin Museum; 3 from Kiukiang, 2 from Shanghai, 3 from Chusan Island (cotypes of *tuberculatus*), 1 from Foochow, 1 from Yunnanfu as well as material from Peiping, the Hwang Ho north of Tsinan, Tsinan and Tungchwan, in the British Museum; 1 from a Peiping market, 1 from Chungking and 1 from China, in the Museum of Comparative Zoölogy; 6 from Paotowchen, 12 from Chintzu, 1 from Niantzekwan, 5 from Hsinglungshan, 1 from Peiping, 1 from a Peiping market, 11 from the Western Hills, 14 from Tsinan, 1 from Chungchow, 6 from Yochow, 1 from Changsha, 16 from Ningkwo, 8 from Hokow, 6 from Chungan Hsien, 3 from Kienyang, 4 from Kienning, 2 from Yenping, 11 from Foochow, 21 from Futsing Hsien, 2 from Fukien, and 4 from Nodda, in the American Museum.

*Remarks*.—Cernov (1930, p. 251), after studying large series of *Amyda* from eastern Asia, concluded that the names *schlegelii*, *sinensis* and *maackii* have been applied to ontogenetic stages of a single species which must of course be known as *sinensis*, and I am strongly inclined to accept his conclusions. Smith (1931, pp. 176 and 178) reserved the name *sinensis* for the so-called typical form found from the region of the Si Kiang southward, *sinensis tuberculata* for specimens from central China. He did not discuss

the status of material from northern China. I cannot correlate his distinctions with the large series at hand and those previously examined, even though juvenile examples from Hainan and Indo-China seem to have uncommonly large and persistent dark ventral spots. Such a variation in color might well be due to a different environment. I have often noticed in the field that the color of these turtles varies greatly with the kind of water in which they live, and there can be no doubt that preservation also brings about change in color as well as in external structural details.

22. *Amyda steindachneri* (Siebenrock)

Plate IV

*Trionyx cartilagineus* Siebenrock, 1903, Sitzber. Akad. Wiss. Wien (math.-natur.), CXII, Abt. I, p. 347 (part: Tongking).

*Trionyx steindachneri* Siebenrock, 1906, Zool. Anz., XXX, p. 579, 2 figs. (type locality, Kaukong River, Hainan; paratypes from Phuc-Son, Annam; and Tongking); 1907, Sitzber. Akad. Wiss. Wien (math.-natur.), CXVI, Abt. I, p. 1766, Pl. (Kwangtung and Kwangsi).

*Description*.—A translation of the original description, based on the type, a juvenile female, follows:

Length of carapace 65 mm., its breadth 62 mm., length of disc 47 mm. Carapace tectiform, with numerous longitudinal rows of closely-set tubercles, that are strongest on the vertebral line; the entire anterior edge bordered with a fringe of distinct tubercles. Epiplastron long, in contact in front of the entoplastron; the latter forms a right angle, whose branches are pointed. Xiphiplastron moderately long and more rounded on the end, not so pointed as in *T. cartilagineus* Bodd. They form therefore an intermediate stage between those of *T. cartilagineus* Bodd. and *T. sinensis* Wiegman. Head moderately large, snout considerably longer than the diameter of the orbit. Symphysis of the lower jaw smooth above, with no trace of a median ridge, somewhat shorter than the diameter of the orbit.

Head olive green above, with only a very few black dots; a black stripe extends forward from the edge of the eye to the base of the snout, another obliquely backward to the neck; likewise two short oblique stripes lie below the eye. Thus the side of the head is divided into several oval areas, which are set off by the dark framing as large, lighter spots. Above the black stripe behind the eye on each side of the head is a large white spot, which extends backward toward the neck and turns into a broad band of the same color. The two spots are separated on the crown by the black color of the neck, which forms a narrow bridge between them. The latter divides in front into two crooked stripes, of which the left runs out into a fine line between the eyes, while the right is severed from the junction. A large, oval, white spot lies just behind the angle of the mouth. Head and neck dirty white below with some darker spots. Carapace dark olive with somewhat lighter spots on its margin; a number of diverse, large, black dots are distributed over the surface. Underside white with numerous dark, cloudy spots. Limbs uniformly brown above, somewhat lighter below.

In the above description, Siebenrock's term "disc" refers only to that part of the dorsal shield underlain by bony structure; his "carapace" refers to the entire dorsal shield or "disc" of this work.

*Distribution*.—This turtle is known from Kwangtung, including Hainan; Kwangsi; Tongking and Annam.

Fang (1930, p. 129) records it from Changnao, Nanning and Tungkueihsu, three localities in Kwangsi, and notes its occurrence in this province as far east as Wuchow and as far north as Liuchow and Tunglan Hsien. He states that it is transported from Kweichow to be sold in Kwangsi.

*Habits and Habitat*.—The presence of *steindachneri* at Ngoi-Tio, Tongking, is evidence that it ascends to at least 5000 feet. On Hainan, however, it was found only a few hundred feet above sea-level.

Mell (1929, p. 252) states that *steindachneri*, in contrast to *sinensis*, does not bite when annoyed.

*Material examined*.—I have seen 1 example from Hainan, in the American Museum; and 1 each from Kwangsi and Ngoi-Tio, in the British Museum.

*Remarks*.—The flesh is prized as an article of diet in southern China and sells as high as two dollars per catty (Fang, 1930, p. 131). On Hainan, I found this turtle valued extremely high in the Nodda market, while *A. sinensis* was sold at a low figure. This fact alone may be taken as an indication that *steindachneri* and *sinensis* are very distinct species. It would be interesting to know just which characteristic of *steindachneri* flesh makes it so palatable. I venture a guess that the difference in edibility is reflected in the life histories of these turtles.

CHAPTER IV  
THE CROCODILIANS  
INTRODUCTION

THE few living crocodiles and alligators are but the remnant of a group once far richer in forms than it is today. All the recent species are aquatic, egg-laying reptiles of relatively large dimensions. Typically they frequent the tropics, only the two species of alligators being inhabitants of temperate regions. Crocodilians are carnivorous and feed on almost any animal small enough to be overpowered.

No true crocodile inhabits China at present even though there is evidence that *Crocodylus porosus* formerly occurred on the extreme southeastern Chinese coasts (Mell, 1922, p. 110).

CLASSIFICATION AND DESCRIPTION

Class **REPTILIA**

Order **LORICATA**

Family **ALLIGATORIDÆ**

The Alligatoridæ include several extinct and three living genera, only one of the latter occurring in Asia.

Genus **Alligator** Cuvier

This genus includes only two living species, one occurring in eastern China, the other (*A. mississippiensis*) in the southern United States. These are the only crocodilians found in temperate regions, as mentioned above.

1. **Alligator sinensis** Fauvel

Figure 16

? *Crocodylus*, sp. Swinhoe, 1870, Proc. Zool. Soc. London, p. 410 (exhibition of living example in Shanghai).  
*Alligator sinensis* Fauvel, 1879, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XIII, p. 34, Pl. (type locality, Wuhu, Anhwei; also records example from Chinkiang, Kiangsu; folklore and summary of previous Chinese and

foreign records).—Vaillant, 1880, Ann. Sci. Nat., Zool., (6) IX, Art. 8 (general notes); 1898, Nouv. Arch. Mus. Hist. Nat. Paris, (3) X, p. 206, Pl. XIII.—Styan, 1884, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XVIII, p. viii (Wuhu).—Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 111; 1894, Ber. Senck. Ges., p. 142 (Wuhu).—Boulenger, 1889, Cat. Chel. Brit. Mus., p. 291; 1890, Proc. Zool. Soc. London, p. 619, Pls. LI-LII (Kiukiang, Kiangsi; summary of previous records).—Werner, 1899, Natur Haus, VII, p. 418 (key).—Cohn, 1908, Jahrb. bremisch. Samml., I, Hlbbd. 2, p. 1, Pl.—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 22 (Wuhu); 1918, XLIX, p. xiv (Wuhu).—Gee, 1919, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) L, p. 184 (Soochow region).—Mook, 1921, Bull. Amer. Mus. Nat. Hist., XLIV, p. 265 (skull).—Barbour, 1922, Proc. New England Zool. Club, VIII, p. 31 (Wuhu).—Müller, 1924, Zeitschr. Morph. Ok. Tiere, II, p. 431 etc. (osteology).—Sowerby, 1925, Natural. Note-Book China, p. 59, Pl. (popular account).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 34 (near Huchow, Chekiang).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 476 (banks of Chingshui River, 7 miles above Wuhu).—Flower, 1930, Proc. Zool. Soc. London, 1929, p. 666 (example 40½ years in captivity).—Ping, 1931, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VII, p. 194 (Tangtu, Anhwei).  
*Alligator chinensis* Guenther, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 219 (Kiukiang).  
 Chinese Alligator, Barbour, 1910, Proc. Acad. Nat. Sci. Phila., LXII, p. 404 (region near mouth of Yangtze; summary of previous records).  
*Alligator sinense* Mook, 1923, Bull. Amer. Mus. Nat. Hist., XLVIII, p. 553, figs. (skull); 1925, Nat. Hist., New York, XXV, p. 407 (popular account of evolution).

*Description*.—Three, rarely 2, pairs of large nuchal scutes, in contact on the median line, the posterior pair always smaller than the anterior ones when 3 are present; 2 small, rounded, isolated scutes anterior to the large nuchals very rarely absent; a semicircular row of small scutes anterior to the 2 isolated ones; 17, very rarely 18, transverse series of dorsal scutes; a maximum of 8, occasionally 6 or 7, dorsal scutes across middle of back; tail strongly compressed and crested posteriorly; greatest total length about 1400 mm. Color dull blackish above with irregular, narrow, vermiculated, dull yellow cross-bands, the latter more distinct in juveniles; yellowish beneath. (Description based on twelve specimens from near Wuhu, American Museum Nos. 28681-28692.)

The fingers of *sinensis* are free, the toes somewhat less than half-webbed. Mook (1923, p. 553) has described the skull in great detail.

*Distribution*.—The Chinese alligator is found only in the lower Yangtze Valley where it is known chiefly from the vicinity of Wuhu and the Taihu. The few specific localities on record are given in the synonymy.

I am convinced that a study of local records would shed much light on the former distribution of *sinensis* during the historic period. There can be little doubt that it ranged widely in eastern China at no very remote time.

*Habits and Habitat*.—Alligators were found hibernating as late as the middle of March, 1922, near the banks of the Chingshui River some seven miles from Wuhu. The specimens were dug out of holes about a foot in diameter and five in depth. Many holes were found together in the dry, treeless but grassy plain through which the river flows at this season. The inhabitants of the vicinity stated that the alligators occur thus in small colonies (Schmidt, 1927, p. 477).

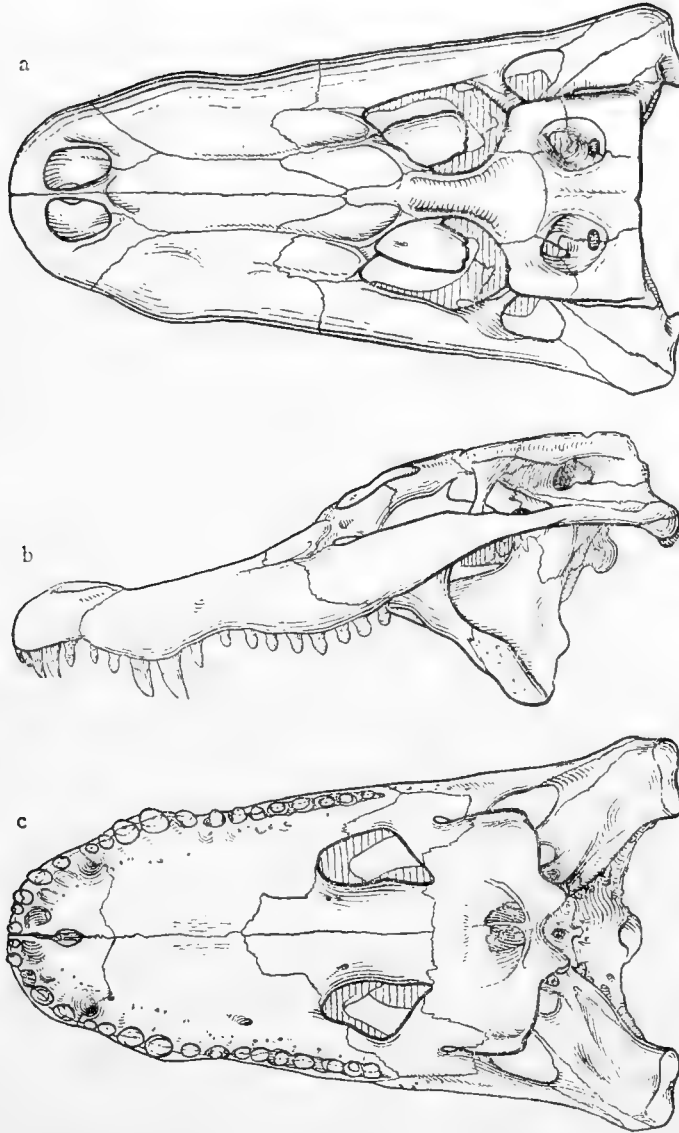


FIG. 16. Skull of *Alligator sinensis*.  $\times \frac{1}{4}$ . a. Dorsal view. b. Lateral view. c. Ventral view. A.M.N.H. No. 23898. (From Mook.)

In spite of the moderately voluminous literature on this rare animal, I know of no first-hand field notes on it save the scanty ones given above. It would be extremely interesting to compare the habits of *sinensis* with those of its only living congener, *mississippiensis*.

*Remarks:*—Mook (1923, p. 562) concludes his paper on *sinensis* with the following discussion of its relationships:

This species resembles the living Florida alligator very closely in some respects but differs from it quite markedly in others.

It has certain resemblances to the various species of *Jacare* which are absent in *A. mississippiensis*.<sup>1</sup> These resemblances are offset by other more fundamental characters, however, and there is no evidence of close relationship.

The nearest approach to the structure of this species is to be seen in the Miocene *Alligator thomsoni*, recently described by the writer. The species may therefore be considered more primitive than *A. mississippiensis*, though it has some specializations absent in the latter. *A. thomsoni* approaches *Allognathosuchus polyodon* from the Bridger, which in turn approaches *Allognathosuchus heterodon* of the Wasatch in a number of characters, so that we may consider the following as a logical morphological sequence: *Allognathosuchus heterodon* (Eocene); *Allognathosuchus polyodon* (Eocene); *Alligator thomsoni* (Miocene); *Alligator sinensis*<sup>1</sup> (Recent); *A. mississippiensis* (Recent). This does not necessarily indicate a line of descent, but it does indicate that *Alligator sinensis* serves partially to bridge the wide structural gap between *A. mississippiensis* and the earlier Tertiary crocodilians. *A. mississippiensis* has been found in Pleistocene deposits. We await the discovery of *A. sinensis* or a very closely related form, in Pleistocene, or even Pliocene, deposits.

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<sup>1</sup> Mook's spelling of *mississippiensis* and *sinensis* has been corrected.



## CHAPTER V

### THE SNAKES

#### INTRODUCTION

ALL legless reptiles of China lacking an external ear-opening belong to this suborder.

The following species and records of such are of varied importance to the fauna of China:

*Cylindrophis rufus*, though not reported from China, is known to occur in Burma and as far north as the Myitkyina District and therefore not far from the Chinese border (Wall, 1926, p. 559). See also Boulenger, 1888, p. 596; Wall, 1921, p. 43, 1923, p. 354, and 1925, p. 806. In the east, this species is known as far north as Hue, central Annam (Schmidt, 1928, p. 80).

*Acrochordus javanicus*, a specimen of which supposedly from Hongkong was examined by Wall (1903, p. 85) in the Hongkong City Hall Museum, has been shown to have a more southern distribution, occurring from Siam southward into the Malay Archipelago.

*Pseudopareas vagus*, although originally described from Hongkong, is now known to inhabit Peru.

#### KEY FOR IDENTIFICATION OF CHINESE FAMILIES

- I. No teeth in upper jaw; body covered above and below with nearly uniform, cycloid scales; tail not laterally compressed. . . *Typhlopidae*, p. 70
- II. Teeth present in both jaws
  - A. Maxillary horizontal, not erectile; fangs, if present, short
    - 1. Mental groove present
      - a. Maxillary bearing several teeth which are never preceded by fangs
        - (1) Vestiges of hind limbs usually evident as a claw-like spur on either side of belly opposite vent; top of head covered by numerous, small, irregular scales. . . . . *Boidæ*, p. 72

- (2) No vestiges of hind limbs; top of head covered by a few, large, regular shields
  - a'. Frontal in contact with a large, azygous occipital shield; scales in 15 rows throughout..... *Xenopeltidæ*, p. 77
  - b'. Frontal in contact with a pair of symmetrical, broadly contiguous parietals..... *Colubridæ*, p. 78
- b. Maxillary always bearing fangs which are never preceded by other teeth
  - (1) Tail round..... *Elapidæ*, p. 331
  - (2) Tail laterally compressed..... *Hydrophiidæ*, p. 354
- 2. No mental groove; scales in 15 rows throughout..... *Amblycephalidæ*, p. 366
- B. Maxillary short, vertically erectile, bearing only long, perforated fangs
  - 1. No loreal pit..... *Viperidæ*, p. 382
  - 2. Loreal pit present..... *Crotalidæ*, p. 385

Not all amblycephalid snakes have 15 rows of scales, this character as given above being intended to apply to the genus *Amblycephalus*.

#### CLASSIFICATION AND DESCRIPTION

##### Class REPTILIA

##### Order SQUAMATA

##### Suborder SERPENTES

##### Family TYPHLOPIDÆ

The members of this family, the so-called blind-snakes, are distributed over the warmer parts of both hemispheres. They are secretive burrowers and worm-like in appearance.

##### Genus *Typhlops* Oppel

This genus occurs in the New as well as the Old World and is widely distributed in tropical and sub-tropical countries.

Although only one form is known to occur in China, another, *T. diardi*, has been collected near the borders of Yunnan (Boulenger, 1888, p. 596, and Wall, 1925, p. 806).

Boulenger's (1893, p. 15) questioned Hongkong record of *Typhlops lineatus* may now be entirely discredited because it is well known that several other Malay snakes undoubtedly secured on Java were credited to Hongkong by Boulenger, all of them being a part of Bowring's collection.

##### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Small, worm-like; no ventral or subcaudal plates; secretive; entirely harmless.

1. *Typhlops braminus* (Daudin)

Figure 17

*Eryx braminus* Daudin, 1803, Hist. Nat. Rept., VII, p. 279 (based on Russell's Ind. Serp., I, p. 48, Pl. XLIII; type locality, Vizagapatam, India).

*Typhlops braminus* Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 70 (Lofaoshan, Kwangtung; Hainan); p. 127 (previous records quoted).

**Description:**—Small and worm-like; body covered above and below with uniform, cycloid scales arranged in twenty rows; eyes concealed under head shields; tail ending in a fine spine; 175 mm. or less in total length.

A series of thirty-seven specimens from Hainan range in length from 87 to 150 mm. and in diameter from 2.3 to 4 mm.; average length 124 mm.; ratio of length to diameter varies from 34 to 48, averaging 41 (Schmidt, 1927, p. 429).



FIG. 17. *Typhlops braminus*. Greatly enlarged. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 19681 from Guam. (From Burt.)

**Distribution:**—Well known on Hainan and in Kwangtung, *braminus* ranges northward in China to Nanan and Changning in southern Kiangsi, and Futsing Hsien, Foochow and Yenping in Fukien. It is one of the commonest snakes on Formosa and the Riu Kiu Islands (Maki, 1931, p. 20).

Distributed widely through southern Asia and the Malay Archipelago including the Philippines. It also reaches the Pacific Islands, Africa, Madagascar, etc.

**Habits and Habitat:**—Mell (1922, p. 114) found *T. braminus* common in southern Kwangtung and observed it to an altitude of 330 meters in Lofaoshan. I found it abundant at Nodoo, Hainan, where it was frequently taken under flower pots. Such a habitat well illustrates its secretive habits.

Two specimens from Nodoo in the American Museum contain, respectively, an insect pupa (probably Dipterous) and the remains of Orthopterous insects, while a third from Nanan contains insects of the order Collembola. Wall (1921, p. 11) states that it eats "the larvæ, pupæ and imagines of ants, and probably beetles, and other insects." According to Taylor (1922, p. 52), it lays elongate eggs. Wall (1918, pp. 378-381, and 1921, pp. 9-13), in his excellent accounts of this snake, records the number of eggs produced at a time as 2-7 and their size (in oviducts) as 4 x 13 mm. His gravid females were secured in Assam from April to July. Mertens (1930, p. 278) and Taylor (1922, l.c.) also give good descriptions of this species.

In Fyzabad, Wall (1907, p. 104) found young *Bungarus candidus* feeding constantly on *braminus*.

*Material examined*.—I have seen the following material from China: 37 specimens from Nodda, 1 from Yenping, 4 from Foochow and 1 from Nanan, in the American Museum; 1 from Amoy and 1 from Fukien, in the British Museum; and 1 from Futsing, in the U. S. National Museum.

*Remarks*.—This species, one of the most widely distributed of all snakes, has obviously been transported by human agency. Nevertheless, its distribution in China appears to be quite natural, conforming well to that of many other southern species.

#### Family BOIDÆ

*Eryx* belongs to the subfamily Boinæ, *Python* to the subfamily Pythoninæ.

#### KEY FOR IDENTIFICATION OF CHINESE GENERA

- |   |                       |
|---|-----------------------|
| I. Premaxillary toothed; labial pits present..... | <i>Python</i> , p. 72 |
| II. Premaxillary toothless; no labial pits.....   | <i>Eryx</i> , p. 75   |

#### Genus *Python* Daudin

The species of this genus are found in southern Asia, Africa and the Indo-Australian region.

In spite of various early records of *P. reticulatus* for China and the much more convincing ones of Wall (1903, p. 85) and Stanley (1914, p. 26), the weight of evidence excludes this snake from the Chinese fauna. It is not unlikely that occasional living specimens are brought into the country, and such stray individuals doubtless are the basis of the records in question. Maki (1931) records no python from Formosa.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SUBSPECIES

Size very large; gaudily blotched pattern; deep pits in rostral and 2 anterior upper labials; scales small and numerous, in more than 50 rows; heavily built and powerful; often vicious.

#### 2. *Python molurus bivittatus* Schlegel

##### Plate V, A, B, C and D

*Python bivittatus* Schlegel, 1837, Phys. Serp., II, p. 403, Atlas Pl. xv (part).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 115 (southern coastal Kwangtung from Swatow to Yeungkong).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 429 (Nodda, Hainan).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 388 (Yuankiang, Yunnan).

*Python molurus* Boulenger, 1893, Cat. Snakes Brit. Mus., I, p. 418 (Hoihow, Hainan).

*Python reticulatus* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 26 (Fukien) (not of Schneider, 1801).

*Python*, Caldwell, 1924, Blue Tiger, p. 146, Pl. VI (near Yenping, Fukien).

*Python molurus bivittatus* Mertens, 1930, Abh. Senckenberg. Naturf. Ges., XLII, p. 287, Pl. VIII (Sumbawa; type locality fixed as Java).

*Description*.—Upper labials 11 or 12, excluded from eye by suboculars; eye encircled by 6 to 8 oculars; scales in 54 to 62 rows on neck, 65 to 72 at midbody and 40 to 44 just before vent; ventrals 255-262; subcaudals 65-71. The pattern appears to have consisted, in some ancestral form, of a middorsal and two lateral rows of large, roughly square, white and black margined blotches. The lateral blotches now have been reduced to little more than their original upper and posterior margins, which remain as rows of more or less curved, black and white markings paralleling the conspicuous middorsal blotches. Anteriorly, an additional set of small, elongate, black and white margined blotches lie immediately lateral to the bold, middorsal ones; a long, pointed blotch extends down the upper surface of the head, while a dark blotch lies just below the eye and a dark stripe extends along the side of the head through the eye. Greatest total length 3353 mm. (skin). (Description based on seven examples from Hainan.)

The Yuankiang specimen, a male, has 13 upper labials; 8 oculars; scales 55-69-46; ventrals 255; subcaudals 65; and measures 863 mm. from snout to tip of tail (Pope, 1929, p. 388). A Hoihow specimen (Boulenger, 1893, p. 418) and one from southern Fukien, both in the British Museum, have 8 and 9, 255 and 259, 61 and 65, oculars, ventrals and subcaudals, respectively.

Wall (1926, p. 559) has described the hemipenis of a specimen from Maymyo, Burma, as "encircled with loose folds," bifid at the tip, and devoid of spines.

*Distribution*.—*P. molurus bivittatus* has been secured in Fukien as far north as the region of Yenping. There are several records for this province but, with the one exception, no definite locality has been given. In mainland Kwangtung, it is recorded from Swatow along the southern coastal region to Yeungkong, while on Hainan it is well known. There is proof of its occurrence in southern Yunnan in the form of the American Museum specimen collected at Yuankiang, and Wall (1925, p. 806) has recorded it from Myitkyina, a locality in Burma not far from the western border of Yunnan. *P. m. bivittatus* probably occurs over considerable areas in extreme southern China.

This subspecies of *molurus* ranges from Upper Burma southward through the peninsula of southeastern Asia to Java and Sumbawa (Mertens, 1930, p. 288). Its presence in the Malay Peninsula and on Sumatra is, however, more or less problematical (Smith, 1930, p. 39; de Rooij, 1917, p. 22; Mertens, 1930, l.c.). It is also recorded from Celebes.

*Habits and Habitat*.—Mell (1922, p. 115) found this snake only in the lower, coastal region of Kwangtung, but the specimen killed near Yenping was discovered in the mountains above that city at perhaps an altitude of 1000 feet, and it is therefore probable that *molurus* inhabits the lower moun-

tains of southeastern China and is not confined to the immediate coastal region. The altitude of Yuankiang is 1500 feet, so *bivittatus* reaches at least that altitude in southern Yunnan. Wall (1921, p. 73) describes *molurus* as a denizen of the plains that ascends to 6000 feet on rare occasions. This statement in part applies to *bivittatus* since Wall did not recognize that form as valid. As yet no difference in habitat preference between typical *molurus* and *bivittatus* has been pointed out.

Mell (1922, l.c.) mentions the preference of *bivittatus* in Kwangtung for the vicinity of water, while I observed that Hainan specimens climbed even large trees with great agility and varied greatly in temperament, some individuals being ready to strike at the slightest annoyance, while others cared little what treatment they received.

The small Yuankiang specimen had eaten a large rat (Pope, 1929, p. 389).

Wall (1912, pp. 447-475, and 1921, pp. 48-73) has written excellent accounts of *molurus*, and, while it is not always possible to tell which statements apply to *bivittatus*, a distinction can sometimes be drawn on geographical grounds. A few points of special interest have been abstracted from his later article as follows:

1. This snake is primarily a jungle inhabitant and a good climber (p. 50).
2. It is thoroughly at home in water (p. 50).
3. Its disposition is on the whole lethargic (p. 51).
4. Although in possession of great strength, it does not crush but asphyxiates its prey by preventing expansion of the chest (p. 53).
5. It is alert both night and day (p. 53).
6. It hibernates in northern India and Burma, and sometimes several individuals are found wintering together (p. 54).
7. Its appetite is omnivorous, leopards, deers of various species, jackals, porcupines, hares, rats, birds, toads, and monitors having been known to fall victim to it. In captivity, it will devour additional kinds of animals (pp. 57-63).
8. The female always remains coiled about her eggs after laying. A single clutch may contain as many as 107 eggs (pp. 64 and 66).

There can be no doubt about the oviparous habits of *bivittatus*.

Finally, in China, man is certainly the chief enemy of the python, for its skin is used in the manufacture of musical instruments, while its flesh is an esteemed table delicacy.

*Material examined*.—I have seen the following specimens: 7 from Hainan and 1 from Yuankiang, in the American Museum; 1 each from Hainan and Fukien, in the British Museum.

*Remarks*.—The question of the status of *bivittatus* has caused much discussion. De Rooij (1917, p. 22), on the one hand, has refused to recognize it as a valid form, while Werner (1930, p. 205), on the other, has treated it as a

distinct species more closely allied to *P. sebæ* of Africa than to *molurus*. In studying material from various localities, I failed to see some of the differences pointed out by Werner, but did observe that all Chinese specimens agree in having the labials separated from the eye by suboculars, a character long ago pointed out as typical of *bivittatus*. Knowing that Dr. Olive Stull Davis is engaged in revising the Boidæ, I wrote to her for advice and she kindly informs me that she considers *bivittatus* a morphologically and geographically distinct form of *molurus*. In addition to differing from *molurus* in possessing suboculars, that exclude the upper labials from the eye, she finds that *bivittatus* has a higher ventral count.

Genus **Eryx** Daudin

The species of this genus occur in northern and eastern Africa, central and southern Asia and southeastern Europe.

OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SUBSPECIES

Size medium; head not distinct from neck, covered with small scales; more than 35 rows of scales at midbody; subcaudals entire.

3. **Eryx miliaris roborowskii** Bedriaga

Plate V, E, F and G

*Eryx miliaris roborowskii* Bedriaga, 1907, Ann. Mus. Zool. St. Pétersbourg, X, p. 193 (type localities, Sachow, Kansu and Lukchun, Sinkiang); 1912, Wiss. Res. Przewalski Cent.-Asien Reisen, Zool., III, Abt. 1, p. 675, Pl. IX (amplified description of cotypes).—Zarevskij, 1915, Ann. Mus. Zool. Acad. Sci. Petrograd, XX, p. 353 (Edsin gol, Ningsia).

*Description*.—A translation of the original description, based apparently on 6 cotypes and more or less inextricably mixed with that of *E. miliaris koslowi*, follows:

The snout tapers gradually toward the front and appears proportionately rather narrow at the end. The dorsal side of the head is flat above the eyes, or again the internasals appear flatly arched; the sides of the head slope rather steeply anteriorly, so that the small shields lying between the eye-ball and the nostrils are not visible from above, and the nostrils as well as the eyes lie completely laterally and, viewed from above, likewise cannot be seen well. The distance between the lower border of the eye and that of the lip is small. The upper head shields are large; behind the internasals there are only two, abnormally three, shields; across the forehead from eye to eye usually 7, rarely 8 small shields are present, and 8 or 9 scales lie around the eye; there also occur to be sure cases in which the circumorbital series consists of 10 scales, but these are only anomalies, since one finds 10 on one side, 8 or 9 on the other, however; there are two longitudinal rows consisting of three scales between the posterior nasal and the anterior border of the eye, and between the lower edge of the eye and the 6th supralabial lie two overlapping plates; abnormally and only on one side these plates are replaced by a single one; the large subocular, which enters the orbit, rests on the 5th supralabial or on the 4th and 5th supralabials; the 5th and 6th, occasionally the 4th and 5th and in part also the 6th, supralabials lie underneath the eye. Beginning with the fourth from the front, the supralabials are divided transversely, so that the 3rd supralabial is the highest

and appears separated from the postnasal only by a small plate. The underside of the tail provided with a single row of plates.

The number of supralabials usually amounts to 11 or 12 on each side, in rare cases only 10; the number of transverse rows of gulars varies between 16 and 23, in var. *roborowskii* it seems to be greater, in var. *koslowi*, on the other hand, smaller; the dorsal scales are in 41 to 47 longitudinal series, the ventrals in var. *roborowskii* disposed in 191-202, in var. *koslowi* in 182 to 186 transverse rows; there are 23 to 32 subcaudals present in the former, 22 or 23 in the latter, yet the number of these scales doubtless has no diagnostic value, since the tail is probably always shorter or longer according to the sex and consequently must also exhibit a different number of shields. It must be added besides that in var. *roborowskii* as well as in typical *miliaris* a rostral ridge is present, even though occasionally only indistinctly indicated, while in var. *koslowi* and particularly in *E. jaculus* this ridge is obliterated. In var. *roborowskii* the ground color of the dorsum is mostly light brown with a tinge of brick-red, in var. *koslowi* more sand-colored; the pattern is clear in the former, for the most part considerably more faintly indicated in the latter, as the characteristic indented, branching and variously connected spots, brown rather than gray, placed transversely on the dorsum, appear broader and more distinctly dark edged in var. *roborowskii*, while in var. *koslowi* these are sometimes very narrow, are little branched, show the tendency to become broken up into small, irregularly outlined spots toward the end of the body and appear distinctly lighter, colored more gray than brown; nevertheless in *koslowi* specimens occur with numerous dark, irregular cross-bands; in this case the nuchal pattern and the postorbital stripe appear distinctly sharper, therefore similar to var. *roborowskii*. The nuchal pattern consists in the latter especially of two brownish gray, more or less distinctly dark-edged spots, sometimes joining in the middle of the nape of the neck and forming approximately a triangle; in *koslowi* mostly a horseshoe-shaped figure is apparent on the nape. In var. *roborowskii* the small dark spots present on the sides of the ventrum are very dark and may be so thickly crowded together that they merge and even form interrupted longitudinal stripes; in the light-colored examples of *koslowi* the marginal spots are very distinctly defined and stand at greater distances from one another. Dark brown streaking, such as Boettger declares that he has seen in his *miliaris*, appears also in both my forms on the dark-colored scales, although it is more distinctly pronounced in var. *koslowi* than in *roborowskii*. In var. *roborowskii* the tail is distinctly cross-banded above, the dark, lateral longitudinal stripes are mostly interrupted; the dorsal surface of the tail in var. *koslowi* is of one color and only laterally dark spotted; in it the dark, lateral longitudinal stripes are decidedly pronounced. The yellow or dirty yellow ventral surface of the animal is more or less strongly dark-dotted; in var. *roborowskii* the dots form a more or less distinctly defined, often interrupted, median stripe on the belly.

Approximate total length . . . . .	442 mm.	503 mm.
Approximate length of head, measured dorsally . . .	17	19
Maximum width of head . . . . .	12	12
Approximate length of body . . . . .	390	444
Length of tail . . . . .	35	40

*Distribution*.—This form of *miliaris* is apparently known only from the following localities:

Sinkiang: Lukchun.

Kansu: Sachow.

Ningsia: Edsin gol; 55 miles northwest of Ningsia (city).



*Habits and Habitat*:—Although nothing specific has been written about the habits of *roborowskii*, it is obviously an inhabitant of deserts.

I can find nothing on the breeding of *miliaris*, but Flower has recently (1933, p. 806) recorded data indicating that *E. jaculus* is ovoviviparous. Other species of *Eryx* probably have similar habits.

*Material examined*:—I have seen one of the cotypes from Lukchun (original number 10069), in the Museum of Comparative Zoölogy; and a specimen collected fifty-five miles northwest of Ningsia, in the U. S. National Museum.

#### Family XENOPELTIDÆ

This family includes but a single genus.

#### Genus *Xenopeltis* Reinwardt

The single species of this genus occurs in southeastern Asia and the Malay Archipelago.

#### OBVIOUS RECOGNITION CHARACTERS

Color brown or blackish above, uniformly light below; 4 diamond-shaped parietals with an azygous shield in the midst of them; scales smooth, iridescent, in 15 rows throughout; secretive, burrowing.

#### 4. *Xenopeltis unicolor* Reinwardt

Plate V, H, I and J

*Xenopeltis unicolor* Reinwardt in Boie, 1827, Isis, p. 564 (type locality, Java).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 115 (Wuyung, Kwangtung, 40 meters).

*Description*:—Preoculars single, large; 2 postoculars; supraocular smaller than upper postocular; a large, azygous interparietal in midst of 4 parietals; 8 upper labials, 4th and 5th entering orbit; scales smooth, in 15 rows throughout; ventrals 164-193; subcaudals 26-31. Brown or blackish above, iridescent; white below; young with whitish head and yellow collar. (Description based on that of de Rooij, 1917, p. 40.)

Mell (1922, p. 115) gives the total length of his Kwangtung specimen as 860 mm., with 82 mm. occupied by the tail.

The hemipenis divides opposite the fourth to fifth subcaudal plates and extends only to the sixth. It is entirely devoid of spines. Proximal to the point of forking, two prominent frills extend across the organ at a considerable interval, while a calyculate area lies distal to the frills. The calyces are few in number and have straight edges. The lips of the sulcus are everywhere prominent, but especially so distal to the point of forking. (Description based on a specimen from Bangkok.)

*Distribution*:—Mell's specimen taken at Wuyung, Kwangtung, is the only Chinese record of this snake that I have found. It has been recorded from Phuc-Son, central Annam, and localities farther south in Indo-China, but it

must be very rare in Tongking, northern Annam, and southern China. Wall (1925, p. 806, and 1926, p. 559) records numerous specimens from Myitkyina District, northern Burma, near the Yunnan frontier, and states that "It appears to be restricted to the basin of the Irrawaddy from Myitkyina southwards, and to river basins further east." It is doubtful whether *unicolor* enters western Yunnan, because it is apparently confined to lower altitudes than are found in that province.

Widely distributed through the lowlands of the peninsula of southeastern Asia and into the Malay Archipelago. It even reaches Palawan and the Sulu Archipelago (Taylor, 1922, p. 76).

*Habits and Habitat*.—I can find no information as to what altitude *unicolor* reaches save that Mell found it forty meters above sea-level. It is generally conceded to inhabit low plains, however.

In spite of being a secretive burrower, this snake is usually described as ferocious. It frequently bites and vibrates the tail when annoyed and is to some degree at least nocturnal.

The following animals form, in part, its natural diet: frogs; snakes (*Ptyas mucosus*, *Natrix stolata*); birds (*Uroloncha punctulata*); rats, mice and shrews.

I secured the above information on the habits of *unicolor* from Wall's excellent popular article (1909, pp. 292-298), two short papers by him (1925, p. 806, and 1926, p. 559) and one by Smith (1914, p. 12).

A gravid female from Bangkok in the Museum of Comparative Zoölogy contains seventeen well-developed eggs enclosing embryos still in very early stages of development. The species, therefore, is probably oviparous.

*Material examined*.—One specimen from Kwangtung in the Berlin Museum collected by Mell is the only Chinese example that I have seen.

#### Family COLUBRIDÆ

##### KEY FOR IDENTIFICATION OF CHINESE SUBFAMILIES

- I. Maxillary teeth not grooved. . . . . *Colubrinæ*, p. 78
- II. Posterior maxillary teeth grooved
  - A. Nostrils valvular and superior; aquatic. . . . . *Homalopsinæ*, p. 308
  - B. Nostrils lateral; terrestrial or arboreal. . . . . *Boiginæ*, p. 318

#### Subfamily COLUBRINÆ

##### KEY FOR IDENTIFICATION OF CHINESE GENERA<sup>1</sup>

<sup>1</sup>Key letters in the Key for Colubrinæ are supposed to have the following relative positions in their horizontal and vertical arrangement.

I	A	1.	a	(1)	a'	a''	(a)	(a')	(a'')	aa	aa'	aa''	(aa)	(aa')	(aa'')
II	B	2.	b	(2)	b'	b''	(b)	(b')	(b'')	bb	bb'	bb''	(bb)	(bb')	(bb'')

It must not be forgotten that this key is constructed for determination of the genera in question as they occur in China only and cannot be used for material from other countries. Moreover, it is entirely artificial and does not pretend to indicate generic relationships. The number of Chinese species in each genus is indicated in the key by the numeral in parentheses preceding each one.

- I. Snout produced into a pointed appendage covered with small scales ..... (1) *Rhynchophis*, p. 276
  - II. Snout not produced into a pointed appendage covered with small scales
    - A. Subcaudals entire; postoculars absent. .... (2) *Achalinus*, p. 180
    - B. Subcaudals divided; postoculars present
      - 1. Temporals and internasals absent. .... (2) *Calamaria*, p. 304
      - 2. Temporals present; internasals normally absent only in *Oligodon eberhardti*
        - a. Scales in an even number of rows. .... (2) *Zaocys*, p. 207
        - b. Scales in an odd number of rows (except posteriorly in *Ptyas mucosus*)
          - (1) Two or more loreals present. .... (2) *Ptyas*, p. 216
          - (2) Loreal single, sometimes absent
- 
- a'. Middorsal scale row enlarged. .... (1) *Dendrophis*, p. 279
  - b'. Middorsal scale row not enlarged
    - a''. Prefrontal entire
      - (a) A single internasal. .... (1) *Rhabdops*, p. 176
      - (b) Two internasals. .... (6) *Opisthotropis*, p. 164
    - b''. Prefrontal divided
      - (a) Rostral prominent, the part visible from above generally as great as or greater than its distance from frontal; scales smooth, in 13-19 rows anteriorly, 13-17 posteriorly
        - (a') Anal divided; scales in 13-15 rows at midbody. . (2) *Oligodon*, p. 300
        - (b') Anal entire. .... (3) *Holarchus*, p. 288
      - (b) Rostral not prominent, the part visible from above less than its distance from frontal
        - (a') Maxillary teeth 36 or more in number, uniform in size; scales smooth, normally in 17 rows throughout. .... (3) *Sibynophis*, p. 81
        - (b') Maxillary teeth 37 or fewer in number
          - (a'') Temporals heavily keeled; scales in 23-25 rows at midbody, all rows keeled. .... (1) *Macropisthodon*, p. 161

- (b'') Temporals not keeled
- aa. Maxillary with one or two toothless spaces, the teeth immediately anterior to the first or only space much larger than those just posterior to it
- aa'. Posterior group of maxillary teeth with three teeth. . . . . (2) *Dinodon*, p. 197
- bb'. Posterior group of maxillary teeth with two teeth. . . . . (4) *Lycodon*, p. 186
- 
- bb. Maxillary without a toothless space preceded by teeth larger than those following it
- aa'. Scales oblique anteriorly; hemipenis deeply forked
- aa''. Last two maxillary teeth greatly enlarged; scales keeled, in 17-19 rows at midbody, 15 before vent; anal divided. . . . . (6) *Pseudoxenodon*, p. 139
- bb''. Last two maxillary teeth not enlarged; scales in 15 rows throughout; anal entire. . . . . (1) *Trirhinopholis*, p. 178
- bb'. Scales not oblique anteriorly
- aa''. Hypophyses developed throughout vertebral column
- (aa) A pair of prefrontals and internasals always present; rarely more than 19 rows of scales present anteriorly or fewer than 17 posteriorly. . . . . (16) *Natrix*, p. 89
- (bb) Either or both internasal and prefrontal divided into more than two scales. . . . . (1) *Helicops*, p. 159
- bb''. Hypophyses present only on anterior vertebrae
- 
- (aa) Scales in 15 rows throughout; body green above and below or green with narrow, dorsal cross-bands present posteriorly. . . . . (3) *Eurypholis*, p. 281
- (bb) Scales in more than 15 rows anteriorly
- (aa') Posterior maxillary teeth longer than anterior; scales smooth, in 17 rows anteriorly, 15 before vent; a conspicuous, black-edged, yellow, middorsal stripe extending from frontal throughout length of body. . . . . (1) *Coluber*, p. 223
- (bb') Posterior maxillary teeth not longer than anterior; no black-edged, middorsal stripe extending from frontal throughout length of body
- (aa'') Maxillary teeth 9; scales smooth, in 19 rows; ventrals 229, subcaudals 51. . . . . (1) *Coronella*, p. 287
- (bb'') More than 9 maxillary teeth. . . . . (14) *Elaphe*, p. 227

This key can be used most efficiently in conjunction with the lists of species by provinces (Chapter IX). For example, much labor may be saved

in identifying a snake from Hopei by disregarding all the genera except *Dinodon*, *Natrix*, *Elaphe* and *Coluber*, not to mention many southern species of the first three. This is obviously an extreme case, but even, let us say, in working with a Chekiang or Yunnan specimen several genera may still be safely eliminated. Ample discretion must of course be exercised and the identifications by key carefully checked against the detailed descriptions given under the species in question. Still quicker results can at times be obtained by bearing in mind that no fewer than 15 of the 22 genera involved include only one or two species whose detailed descriptions can be readily checked against any snake that has been brought to a puzzling character in the key. Finally, I am convinced that, providing a normal and undamaged individual is being identified, no serious difficulty will be encountered until the character "hypophyses developed throughout the vertebral column" is reached. However, this difficulty will greatly diminish if it be remembered that, besides *Elaphe* and *Natrix* (which can nearly always be separated by difference in scale formulas), three of the four genera following this point are represented in China by only a single species each, while the third, *Eurypholis*, is readily recognized by its characteristic scale formula and the predominantly green coloration of its species.

#### Genus *Sibynophis* Fitzinger

*Sibynophis* Fitzinger, 1843, Syst. Rept., p. 26 (type, *Herpetodryas geminatus*).

Although not large, this obviously very ancient genus is found in Central America, southern Mexico, Madagascar, the Comoro Islands, southern Asia and the Malay Archipelago. It is characterized chiefly by the loose attachment of the dentary to the articular and by its numerous, small, maxillary teeth of uniform size.

Long known as *Polyodontophis*, the correct name was shown to be *Sibynophis* by Stejneger in 1910 (p. 102).

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Size small; color of dorsum uniform, with or without dark stripes or longitudinal series of dark spots; upper labials light; head and anterior neck with one or two black cross-bands, sometimes indistinct; scales smooth, normally in 17 rows throughout; habitus very attenuate; inoffensive.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Ten upper labials, only the very large eighth in contact with the single anterior temporal. . . . . *collaris*, p. 86
- II. Nine upper labials, eighth not very large; two anterior temporals, the lower larger and in contact with the seventh and eighth upper labials, seldom entering labial margin (rarely eight upper labials, the sixth and seventh in contact with the lower anterior temporal)
  - A. Subcaudals 83. . . . . *grahami*, p. 88
  - B. Subcaudals 98 or more. . . . . *chinensis*, p. 82

5. *Sibynophis chinensis* (Guenther)

Figure 18

*Ablabes chinensis* Guenther, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 220 (type locality, Ichang, Hupeh).

*Polyodontophis collaris* Boulenger, 1890, Fauna Brit. India, p. 302 (part); 1893, Cat. Snakes Brit. Mus., I, p. 184, Pl. XII (part: type of *sinensis* [= *chinensis*]); 1899, Proc. Zool. Soc. London, p. 163 (Kuatun, Fukien) (not of Gray, 1853).—Blackwelder, 1907, Carnegie Inst. Wash. Pub. No. 54, p. 483 (Shihchuan, Shensi) (not of Gray, 1853).—Despax, 1913, Bull. Mus. Hist. Nat., Paris, XIX, p. 180 (Mienning, Szechwan, 2000 meters) (not of Gray, 1853).—Thompson, 1914, Proc. Zool. Soc. London, p. 381 (Mokanshan, Chekiang; anatomy) (not of Gray, 1853).—Angel, 1920, Bull. Mus. Hist. Nat., Paris, XXVI, p. 112 (Kweichow) (not of Gray, 1853).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 115 (Lofaoshan and Linping, Kwangtung) (not of Gray, 1853).—Vogt, 1924, Zool. Anz., LX, p. 339 (not of Gray, 1853).

*Sibynophis hainanensis* Schmidt, 1925, Amer. Mus. Novitates, No. 157 (type locality, Nodoo, Hainan); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 430, fig. 13 (amplified description of type).

*Sibynophis collaris chinensis* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 64 (Foochow and Kuliang, Fukien).—Chang and Fang, 1931, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VII, p. 251, fig. 1 (Chihsiahsan and Nanking, Kiangsu).

*Sibynophis collaris hainanensis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 200.

*Description*.—Upper labials 9, very rarely 8, 4th to 6th, very rarely 3rd to 5th, entering orbit; preoculars single; postoculars 2; anterior temporals normally 2, the lower very rarely entering labial border, in contact with 7th and 8th upper labials, very rarely with 6th and 7th; posterior temporals 2; scales smooth, in 17 rows throughout; ventrals in six males 168-183, in twenty females 171-183; subcaudals in three males 107-122, in sixteen females 98-115; two largest males measure from snout to vent 406 and 395, females 463 and 444 mm., respectively. (Description based on twenty-six examples from Yenping and Chungan Hsien.)

American Museum No. 34102 from Futsing Hsien, a male, has 9 upper labials, but the lower anterior temporal enters the labial border on one side. Its ventrals and subcaudals are 167 and 109 respectively and the scale rows are reduced to 15 before the vent.

Pope (1929, p. 390) noted the color characters as follows:

. . . The variability of the color pattern in the twenty-seven Fukien examples described above is striking. The head is always dark with a light patch on either side at the posterior edge of the dark area. From the center of the edge of the dark area a line always runs posteriorly. This line may extend even back on to the tail and often there is an additional line on either side parallel to it. Sometimes the central line barely extends back of the neck and in some specimens this line is present but the parallel lines are not evident. The lines may take the form of rows of dots. In the present series about one-third have three distinct lines and another third only the beginning of the central line, while the rest have combinations of the two extreme colorations. The pair of lateroventral lines is always present.

The maxillary counts of six Chungan Hsien examples (American Museum Nos. 34532 and 34534-34538) are 38, 40, 42, 37, 41 and 36, respectively. These counts were made on one side only. The teeth in this species are sub-equal in size.

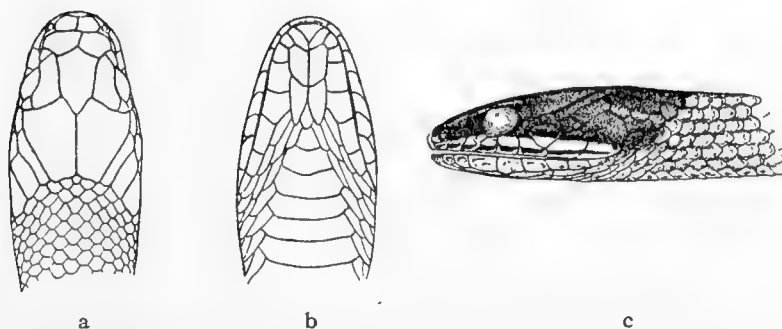


FIG 18. *Sibynophis chinensis*.  $\times 2$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 27788 from Nodoo, Hainan.

The original description, based on the type specimen, a female, follows:

. . . ten upper labial shields, the eighth of which is excluded from the labial margin. Scales in seventeen rows. One præocular, two postoculars. The occipital does not touch the lower postocular; temporals  $1 + 2$ , the anterior in contact with both postoculars. Ventrals 182; of the tail nearly one half has been lost, the mutilated part being protected by fifty-three pairs of subcaudals, so that the whole number may be estimated to have been between eighty and ninety. Upper parts nearly uniform brownish gray, the posterior part of the trunk indistinctly showing a series of whitish spots along each side of the back. No black dots along the vertebral line. The black cross bands between the eyes and on the neck are present as in *Ablabes Humberti* and *Ablabes collaris*, but much less distinct. Abdomen white, each ventral shield with a black dot on each side. Trunk measures 15 inches and its tail was probably  $5\frac{1}{2}$  inches in length.

The hemipenis is not forked and extends to the ninth subcaudal plate. The three or four very large spines opposite the third and fourth subcaudals are followed by numerous similar but smaller ones that gradually decrease in size distally but continue, on the side opposite the sulcus, nearly to the tip of the organ. About midway between the origin and terminus of this spinous area, and adjacent to the sulcus, a calyculate region begins and widens rapidly until it occupies the entire width of the end of the hemipenis. The calyces have scalloped edges and the line of demarcation between them and the spines is conspicuous and abrupt, even though the calyces immediately adjacent to the spines have spinous edges. Proximal to the first large spines and intermixed with some of them, are numerous, minute ones. These continue distally along the lips of the sulcus to the origin of the calyculate region. The sulcus terminates among the calyces a short distance proximal to the end of the hemipenis. Its lips are nowhere conspicuously raised and are calyculate in the calyculate region. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—In China, *S. chinensis* is known with certainty to occur at the following localities:

Kiangsu: Chihsiashan.

Chekiang: Tunglu; Mokanshan.

Fukien: Futsing Hsien; Kuliang; Yenping; Chungan Hsien; Kuatun.

Kwangtung: Lofaoshan; Linping.

Hainan: Nodda.

Kwangsi: Lohsiang.

Kweichow: (no specific locality).

Hunan: Changsha.

Hupei: Ichang.

Szechwan: Muping; Chouchiakou; Mienning.

Shensi: Shihchuan.

Steindachner's (1896, p. 506) record for Shanghai, Stejneger's (1925, p. 65) for Foochow, and that of Chang and Fang (1931, p. 252) for Nanking, require confirmation.

Records of *collaris* for Tongking (Mocquard, 1905, p. 318), Laos (Angel, 1929, p. 76) and Annam (Boettger, 1901, p. 50) are probably based on specimens of *chinensis*. I have seen no material from French Indo-China.

*S. chinensis* is well known on Formosa where it has been accorded sub-specific rank by Maki (1931, p. 25) under the name of *formosensis* and by Mell (1931, p. 201) under that of *parkeri*. I do not believe that the slightly lower ventral count of Formosan material warrants its recognition as a distinct form.

*Habits and Habitat*:—Like its ally, *collaris*, the present form is a mountain snake. Mell (1922, p. 115) found its vertical range in Kwangtung to be from 400 to 800 meters above sea-level; Despax (1913, p. 180) records two specimens taken at 2000 meters in Szechwan, and I have seen one from Muping in the U. S. National Museum collected at 6000 feet. However, several of the locality records show that it may also be found only a few hundred feet above sea-level, especially in eastern central China.

I found this graceful snake common in the mountain bamboo groves and forests about Yenping and Kuatun, where it was often encountered gliding over the shady forest floor and I recall seeing as many as three in one day. They did not strike or bite (Pope, 1929, l.c.).

*S. chinensis* resembles *collaris* in food habits as well as habitat preference. Skink remains were found in the stomachs of three, fragments of some *Takydromus* species in two other Fukien specimens (Pope, 1929, l.c.). A Changsha example in the American Museum contains the end of a lizard's tail, while one from Tunglu, in the Museum of Comparative Zoölogy, holds remains of a lizard, probably a skink.

The following data on the breeding of Fukien *chinensis* have already been recorded by me (1929, l.c.):

Four [preserved] females contained from two to four eggs each. A fairly well-developed



egg measured 33 x 9.5 mm. On August 22 three white eggs (No. 34539) were brought in at Kuatun. Two of them measured 36.5 x 15 and 34 x 13.3 mm. respectively, while the third was only 29.5 mm. long. Each contained a fully developed and well-pigmented snake, the longest of which measured 203 mm. from snout to tip of tail. The color pattern is identical in all three. The lines are evident, but faint everywhere except at the beginning of the central one. In the entire series of this species, as borne out by these three as well, there is no correlation between age and color pattern.

Re-examination of the embryos from lot of eggs No. 34539 shows that each has an egg-tooth.

Both of the females collected by me in the Yenping mountains between April 12 and June 2, 1925, were gravid.

*Material examined*:—I have seen the following Chinese material: 29 specimens from Fukien, 1 each from Changsha, Hainan, and an unknown Chinese locality, in the American Museum; the type and 2 examples from Kuatun, in the British Museum; 1 from Tunglu, in the Museum of Comparative Zoölogy; 1 each from Foochow, Kuliang, Kuatun, Chouchiakou, Muping and Shihchuan, in the U. S. National Museum.

*Remarks*:—A recent, more thorough comparative study than I had made in 1929 (p. 389) convinces me that *chinensis* and *collaris* are distinct species and only the acquisition of additional material from new localities clearly demonstrating intergradation will suffice to reduce the former to subspecific rank again (compare Stejneger, 1925, p. 64). In fact, Wall (1909, p. 340) was "strongly inclined" to recognize *chinensis* as "a species apart." The grounds for separation of the two forms may be briefly summarized as follows:

1. The hemipenes seem to differ in four details as enumerated under *collaris*. These differences may be considered specific until proved otherwise.
2. As stated under *collaris*, the anterior temporal in that form is always single and in contact only with the much enlarged eighth upper labial, while, in *chinensis*, there are two anterior temporals and only nine (instead of ten) upper labials, the lower anterior temporal being in contact with the seventh and eighth labials. Although the lower anterior temporal of *chinensis* may rarely enter the labial margin and thus form an arrangement resembling that found in *collaris*, I have seen or read of only a single individual from the Chinese region exclusive of Yunnan exhibiting this arrangement on both sides (Wall, 1903, p. 84, Hongkong specimen). Such a rare exception can scarcely be considered normal. *S. chinensis* may very rarely have only eight upper labials with the sixth and seventh adjacent to the lower anterior temporal, but such a condition obviously does not in the least affect the difference between *collaris* and *chinensis* under discussion.
3. There are two dark bars across the head of *collaris*, one just behind the eyes, the other across the posterior third of the parietals. In *chinensis*, the anterior of these bars is often present and the posterior third of the parietals dark but the continuity of the darkened hinder ends of the parietals with the dark nuchal blotch prevents the formation of the posterior head bar so conspicuous in *collaris*. Unfortunately, I have only one (Kachin Hills) specimen of *collaris* for comparison but its head pattern cannot be matched by a single individual of

*chinensis* in the American Museum. Anderson (1879, p. 811) describes his Husa Valley example as also having a distinct band across the ends of the parietals.

4. Stejneger (1925, p. 65) has already pointed out the fact that *chinensis* has a somewhat higher ventral count than *collaris*. The difference is slight, however.

#### 6. *Sibynophis collaris* (Gray)

##### Figure 19

*Psammophis collaris* Gray, 1853, Ann. Mag. Nat. Hist., (2) XII, p. 390 (type locality, Khasya).

*Ablabes collaris* Anderson, 1879, Zool. Res. W. Yunnan, p. 810 (Husa Valley, Yunnan).

*Polyodontophis collaris* Boulenger, 1890, Fauna Brit. India, p. 302 (part); 1893, Cat. Snakes Brit. Mus., I, p. 184, Pl. XII (part).—Haas, 1931, Zool. Jahrb., Anat., LIV, p. 334, figs. 1-2 (anatomy of head).

*Sibynophis collaris chinensis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 200 (part: West Yunnan).

*Description*.—Upper labials 10, 4th to 6th entering orbit; 8th and 10th largest; preoculars single; postoculars 2; anterior temporals single; posterior temporals 2, the lower divided vertically; scale rows 17; ventrals 173. (Description based on a specimen from the Husa Valley.)

Wall (1908, p. 315) gives the ventral and subcaudal counts of twenty-four Shillong specimens as follows: ventrals in ten males 168-174, in twelve females 168-179; subcaudals in males 107-118, females 103-112. The scales are uniformly in 17 rows throughout and approximately half of the series have imperfect tails. In every specimen of this series, as well as all those of a still larger lot (58) secured in the Darjeeling region (Wall, 1909, p. 340), the anterior temporal is single and in contact only with the much enlarged eighth upper labial. This character is of major importance. The largest individual among this series of fifty-eight was a female 780 mm. in total length, while the smallest measured only 216 mm., and was probably a hatchling. It was killed in July.

A Huton male (American Museum No. 50801) has 167 and 117 ventrals and subcaudals, respectively, and 45, possibly 46, maxillary teeth on the left side.

The original description follows:

Olive, very minutely black speckled, forming darker edges to the scales, and a broad rather darker band on the lower part of each side; a broad band across the nape, two indistinct narrow bands across the crown, a series of spots on the middle of the front of the back along each side of the ventral shield, becoming confluent behind into a more or less continued narrow streak on the side of the tail, and a narrow streak on each side of the face through the middle of the eyes to the temple, black. Lips, under part of body, and band across the temple and behind the black nuchal spot, white; scales smooth, thin. Head rather short. Eyes moderate, pupil round, one anterior and two posterior ocular shields and one small loreal shield.

In young specimens the vertebral spots are continued to the tail; there is a series of very small black specks on each side of the middle of the front ventral shield, and the labial shields are dark-edged. The upper end of the ventral shield is olive and minutely speckled like the lateral scales.

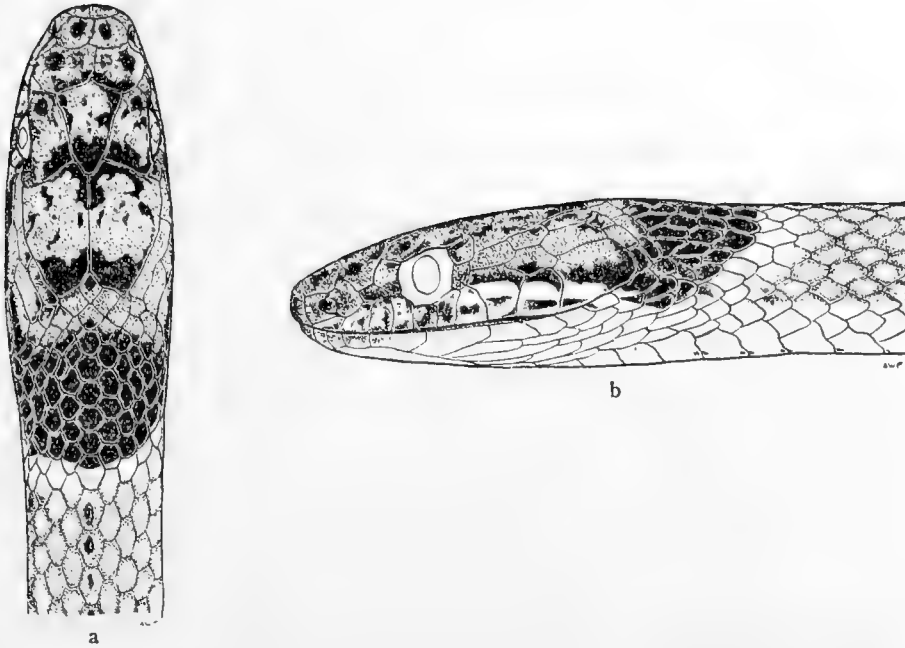


FIG. 19. *Sibynophis collaris*.  $\times 3\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 50801 from Hutan, Burma.

Comparison of the hemipenis of a specimen of *collaris* from the Kachin Hills (American Museum No. 50801) with that of *chinensis*, reveals a general similarity of structure but certain definite, specific differences, as follows:

1. The large spines are much slenderer in *collaris*.
2. The first of the large spines lie opposite the fifth subcaudal in *collaris*, while, in *chinensis*, they are opposite the third and fourth. These same spines encroach upon the sulcus and the relatively reduced calyculate region much more in *collaris* than in *chinensis*. In the former, even the sulcus lips bear some rather large instead of only minute spines.
3. In *chinensis*, the bases of the first large spines are beset with numerous minute ones, but such is not the case in *collaris*.
4. The sulcus much more nearly approaches the tip of the organ in *collaris* than in *chinensis*.

*Distribution*.—This snake has been secured in China only from the Husa Valley of western Yunnan.

Known with certainty to range from Simla, in the western Himalayas, eastward through Assam and Burma to western Yunnan; thence southward to Calcutta, northwestern Siam, and the Arakan Hills and Pegu Yomas.

*Habits and Habitat*.—*S. collaris* is an inhabitant of mountains, ascending to an altitude of 10,000 feet in the Himalayas (Stoliczka, 1871, p. 430), while Wall (1909, p. 340) reports it as rare below 3000 feet in the Darjeeling region.

This species has been reported to feed chiefly on *Sphenomorphus indicus*, but remains of other skinks (*Mabuya* and *Lygosoma*) and a snake's tail have been found in preserved specimens (Wall, 1908, p. 315, 1909, p. 340, 1925, p. 806, and 1926, p. 559).

Two eggbound females were killed in the Kachin Hills on June 6. One of these measured 506 mm. and held 2 elongate eggs 35 x 6 mm., while the other was 584 mm. long and contained 4 eggs, each more than an inch in length (Wall, 1926, l.c.). Two Shillong specimens 228 and 254 mm. long were collected September 10 and 15, respectively (Wall, 1908, l.c.), and, as stated above, a 216 mm. individual was killed during July in the region of Darjeeling.

Neither one of two specimens found by Wall (1908, p. 316) attempted to bite during capture.

*Material examined*:—I have seen no Chinese material of *collaris*.

#### 7. *Sibynophis grahami* (Boulenger)

Figure 20

*Polyodontophis Grahami* Boulenger, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 132 (type locality, between Yunnanfu and Kutsing, Yunnan).

*Sibynophis grahami* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 506, fig. 8 (Yunnanfu and Wutingchow, Yunnan).

*Description*:—Upper labials 9, 4th to 6th entering orbit; preoculars single; postoculars 2; anterior temporals 2, the lower excluded from labial border, in contact with 7th and 8th upper labials; posterior temporals 2; scales smooth, in 17 rows throughout; ventrals, in male 194, female 188; male from snout to vent 400 mm., female 218 mm. (Description based on 1 specimen from Yunnanfu and 1 from Wutingchow.)

The maxillary counts of these two specimens (American Museum No. 18080, Yunnanfu, and No. 12804, Wutingchow) are 42-? and 44-46, respectively.

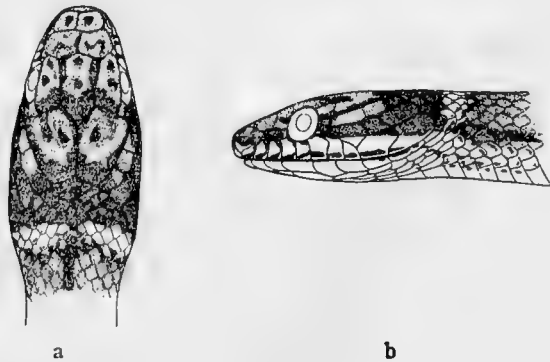


FIG. 20. *Sibynophis grahami*. x 2. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 12804 from Wutingchow, Yunnan.

The original description, based on the type specimen, follows:

Rostral once and a half as broad as deep, just visible from above; suture between the internasals nearly as long as that between the præfrontals; frontal much longer than its distance from the end of the snout, shorter than the parietals; loreal as long as deep; one præocular; two postoculars, only the upper in contact with the parietal; temporals 2 + 2; eight upper labials, fourth and fifth entering the eye; four lower labials in contact with the anterior chin-shields, which are longer than the posterior. Scales in 17 rows. Ventrals 185; anal divided; subcaudals 83. Reddish brown above, with three dark brown longitudinal lines, which become more and more indistinct after the anterior fourth of the body; head dark brown, with a black streak on each side and a black bar behind the parietals; a white streak along the upper labials and another behind the occipital bar; lower parts white, with a black dot at the outer end of each shield; on the posterior part of the body and on the tail these dots are confluent into a black lateral line. Total length 350 mm.; tail 60.

The hemipenis of the Wutingchow male bears a striking resemblance to that of the Chungan Hsien *chinensis* described under that species.

*Distribution*.—*S. grahami* is known only from the type locality; Yunnanfu; and Wutingchow.

Smith's (1930, p. 681) record for Tongking is apparently based on an error.

*Habits and Habitat*.—This rare species is obviously an inhabitant of the high Yunnan plateau.

*Material examined*.—I have seen the type, in the British Museum; also 1 example from Yunnanfu and 1 from Wutingchow, in the American Museum.

*Remarks*.—In view of the fact that most specimens of *chinensis* have incomplete tails when collected, one would assume *grahami* to be based on an imperfect individual, but such is not the case. The relationships of *grahami* are obviously with *chinensis* rather than with *collaris*, and it would not be surprising to find, upon acquisition of new material, that *grahami* and *chinensis* intergrade.

Judging by the article in which *grahami* is described, its type locality is the Yunnanfu district, but the type is actually labeled as from between Yunnanfu and "Kale Tsing Fou." The latter locality can be no other than Kutsing, a fu city northeast of Yunnanfu.

#### Genus *Natrix* Laurenti

This enormous genus of some fourscore species is widely distributed over North America, Africa, Europe, Asia and the Malay Archipelago, even reaching New Guinea, northern Australia and adjacent islands.

Many of the Chinese species of *Natrix* fall into groups of rather closely allied forms as follows:

*N. aequifasciata*, *percarinata* and *annularis* comprise a small group characterized chiefly by a banded pattern, a certain uniformity of habitus and distinctly semi-aquatic habits.

*N. sauteri*, *popei* and *craspedogaster* are characterized by marked resemblance in pattern, especially of the upper labials, slender habitus and probably also in similarity of habits.

*N. biteniata* and *octolineata* are alike in many obvious ways.

*N. tigrina* and *subminiata* are similar in habitus and coloration, while a nuchal groove is normally present in the latter, occasionally suggested in the former.

*N. nuchalis*, with its very evident nuchal groove, is somewhat allied to the preceding group. When the nuchal groove is well developed, as in *nuchalis*, it is at once recognized by the obviously paired middorsal row of scales on the neck, while a nuchal count indicates an even number of scale rows.

The species collected by Anderson in western Yunnan and identified by him (1879, p. 817) as *Tropidonotus modestus* Guenther, apparently represents a new form closely allied to *modestus*. The Huton snake listed by Wall (1925, p. 809) as "*Nerodia modesta*?" is probably identical with Anderson's Yunnan specimens. Due to the impossibility of securing Yunnan material, I am unable to settle this question now. It should be remembered that Wall later (1926, p. 560) recorded four examples of *N. modesta* from Huton, so presumably he would now remove the doubt from his 1925 record.

I have examined in the Berlin Museum two snakes (one of them No. 27694) collected by Mell in northern Kwangtung which apparently were the basis of his 1922, p. 116, *Tropidonotus modestus* as well as his later (1931, p. 203) *Natrix khasiensis* > *gilhodesi* and am convinced that neither identification is correct, the snakes in question probably representing a new form. No. 27694, a male 400 mm. in length from snout to vent, has 3 upper labials anterior to, 3 posterior to, and 3 entering the eye, single preoculars and anterior temporals but 2 postoculars, on either side. The internasals are moderately narrowed anteriorly; ventrals 146; tail broken; scale rows 19-17, with 19 at midbody and all but the outer row keeled. A distinct but narrow light stripe extends posteriorly from the lower postocular across the tip of the seventh upper labial, near the upper extremities of the eighth and ninth and onto the neck, where it bends upward to the sixth and seventh scale rows along which it extends for some distance. Before reaching the vent, it drops to the fifth and sixth rows. This stripe is nowhere on the body as distinct as it is on the head and neck. The dorsum is generally dark and devoid of conspicuous markings but a weak checker pattern is faintly visible throughout. Each ventral has a dark spot near either end, while between these spots the ventrum is immaculate. Save for the lateral stripe already described and a little light area on the lower edges of all but the first and second upper labials, the dorsal edges of those anterior to the eye and the lower parts of the loreal and preocular, the side and top of the head are dark with very weak vermiculations. The throat is light with diffuse, dark spots. The other specimen examined is obviously the same species, for it differs only in having slightly more extensive light areas on the side of the head and throat. It is a juvenile female with 143 ventrals and 101 subcaudals. These snakes are very likely the same species as those from the Langbian Plateau of southern Annam identified by Smith (1921, p. 426) as *Tropidonotus johannis*, but only a closer comparison than I was able to effect can solve this problem. *N. inas* (Laidlaw), of the Malay Peninsula, bears a strong resemblance to the Kwangtung and Annam snakes in question.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Scales keeled, rarely in more than 19 rows anteriorly or fewer than 17 posteriorly; anal divided.

KEY FOR IDENTIFICATION OF CHINESE SPECIES<sup>1</sup>

- I. A conspicuous, light, black-edged, vertical bar extending upward from the mouth immediately behind the eye and another similar one just anterior to the eye; subcaudals 116-121; body and tail long and slender, devoid of encircling bands of color; more than 40 maxillary teeth. . . . . *ornaticeps*, p. 114
- II. Eye not preceded and followed by light, black-edged bars; not more than 100 subcaudals; fewer than 40 maxillary teeth
- A. Conspicuous bands usually completely encircling the body, sometimes indistinct or wanting dorsally (and ventrally as well in *percarinata*)
1. Normally not more than one labial entering the eye, all rarely excluded from it by suboculars; maxillary teeth 23-28
- a. Bands encircling body 16-21, those on tail 7-12, the former constricted on the flanks and usually double on the back and belly (not double in very young individuals); belly devoid of red; head long, its sides viewed from above nearly straight; labials rarely excluded from eye. . . . . *aequifasciata*, p. 93
- b. Bands encircling body very numerous, more than 30 on body and 14 on tail; belly red between the cross-bands; head moderately long, its sides viewed from above distinctly convex; all labials never excluded from eye. . . . . *annularis*, p. 95
2. Two labials entering the eye; no red on belly; body bands, if distinct, at least 30 in number; maxillary teeth 29-32. . . . . *percarinata*, p. 116
- B. Body not encircled by bands
1. Nuchal groove more or less developed
- a. Nuchal groove always well developed; upper labials six or fewer; a single anterior temporal. . . . . *nuchalis*, p. 109
- b. Nuchal groove sometimes only poorly developed; upper labials eight or nine, rarely seven; two anterior temporals. . . . . *subminiata*, p. 131
2. Nuchal groove absent (sometimes rudimentary in *tigrina lateralis*)
- a. A conspicuous, divided or simple, black nuchal bar followed for a considerable distance by black cross-bars or checker spots separated by red interspaces; body otherwise predominantly green, belly green and black; two preoculars. . . . . *tigrina lateralis*, p. 135

<sup>1</sup>Key letters in the Key for the species of *Natrix* are supposed to have the following relative positions in their horizontal and vertical arrangement.

I	A	1	a	(1)	a'	a''	(a)	(a')
II	B	2	b	(2)	b'	b''	(b)	(b')

- b. Neck and anterior part of body devoid of conspicuous, black cross-bands or checker spots separated by red interspaces; body nowhere predominantly green
- (1) Dorsum distinctly lineate throughout, devoid of cross-bars and checkering
- a'. Scales strongly keeled and distinctly notched at their posterior extremities. . . . . *bitæniata*, p. 99
- b'. Scales not strongly keeled, not or scarcely notched at their posterior extremities. . . . . *octolineata*, p. 112
- (2) Pattern not distinctly lineate throughout
- a'. A conspicuous lateral line along the belly formed by a black spot on the end of each ventral; belly immaculate between this line and its fellow; dorsum with no pattern or only a faint one; a whitish area on either side of the neck variable in size and shape, sometimes part of a light, longitudinal stripe and often inconspicuous (in *chrysarga*, lateral, ventral spots may be present but they are seldom evident anteriorly and the belly is often pigmented between them; the dorsum always has a double row of conspicuous, light spots; a light marking, usually in the form of a V with the apex directed posteriorly, is present on the neck)
- a''. Ventrals 165-175; subcaudals 85-91 . . . . . *johannis*, p. 106
- b''. Ventrals 157 or fewer
- (a) Ventrals 138 or more; scales 19-17; five, rarely six lower labials in contact with anterior chin-shields. . . . . *craspedogaster*, p. 103
- (b) Ventrals 140 or fewer
- (a') Upper labials seven; scales in 17 rows throughout. . . . . *sauteri*, p. 125
- (b') Upper labials eight; scales 19-17; four lower labials in contact with anterior chin-shields. . . . . *popei*, p. 123
- 
- b'. No lateral line along the belly formed by a black spot on the end of each ventral; a conspicuous dorsal pattern
- a''. Internasals broadly truncate anteriorly; a row of small, whitish spots along either side of the back, more or less connected, or even supplanted anteriorly, by black spots; scales heavily keeled, keels being present even on the outermost rows. . . . . *chrysarga*, p. 101
- b''. Internasals much narrowed anteriorly; back without whitish spots along either side, or, if present, such spots are boldly connected anteriorly by black cross-bands, and posteriorly



coalesce to form a longitudinal stripe; scales keeled, but at least one outermost row smooth

- (a) Anterior temporals normally single; three upper labials normally entering eye; all but outermost row of scales on either side keeled. . . . . *stolata*, p. 128
- (b) Anterior temporals normally two; two upper labials normally entering eye; at least two outermost rows of scales on either side smooth. . . . . *piscator*, p. 120

#### 8. *Natrix aequifasciata* Barbour

Figure 21

*Natrix aequifasciata* Barbour, 1908, Bull. Mus. Comp. Zool., LI, p. 317 (type locality, Wuchih Mts., Hainan); 1909, Proc. New England Zool. Club, IV, p. 66, Pl. VII (original description repeated, cotypes figured).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 69 (Yenping, Fukien).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 507, fig. 9 (Futsing Hsien, Fukien).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 50 (Lohsiang, Kwangtung).

*Natrix annularis* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 116 (part: Tinghushan, Lofao-shan and Wuyung, Kwangtung).

*Description*.—Upper labials 9, very rarely 8; preoculars 1, very rarely 2; postoculars from 2 to 5, usually 3; suboculars 1 to 3 or lacking; anterior temporals 2 or 3, rarely 4; posterior temporals 2 or 3, rarely 4; scales keeled, 19-17; ventrals in ten males 142-153, in ten females 142-148; subcaudals in six males 67-75, in seven females 69-76. (Description based on ten specimens from Futsing Hsien, one from Foochow, and eighteen from Lohsiang.)

In the adult, each of the bold, black bands of the young is generally divided on the back as well as on the belly by a conspicuous island of ground color. As in most species of *Natrix*, a considerable amount of variation in details of pattern is exhibited. The ontogenetic color change of this species is worthy of special note.

The relation of the upper labials to the eye in the series of ten Futsing Hsien specimens described above may be summarized as follows:

A single labial enters the eye with 4 anterior and 4 posterior to it in seven individuals, there being no variation from side to side.

In two individuals, the condition on one side is the same as in these seven, while the labial lying just below the eye is excluded from it by a subocular on the other.

One example is unusual, having 3 upper labials anterior, 1 entering and 4 posterior to the eye on one side, 3 anterior, 2 entering and 4 posterior to it on the other.

The Foochow individual, also included in the preceding standardized description, has the usual 9 upper labials with the middle one entering the eye, while a Futsing Hsien specimen, not described above, has 9, none of which enters the eye.

*N. aequifasciata* is apparently unusual in failing to show sexual dimorphism in ventral and subcaudal counts. This question warrants further investigation. See Fan, 1931, p. 52, and Pope, 1929, pp. 362 and 391, for comparative data.

There is apparently also a corresponding lack of sexual difference in tail length.

The three largest of five males from Fukien measure 735, 578 and 560 mm. from snout to vent, the three largest of six females 1100, 763 and 701 mm. The largest of these females is 1420 mm. in total length and 153 mm. in circumference at the largest part of the body, truly a gigantic *Natrix*. (Pope, 1929, p. 391.)

The males often have well-developed tubercles on the chin-shields and first pair of lower labials (Pope, 1929, l.c.). Certain species of American *Natrix* have this same sexual character (Blanchard, 1931, p. 95).

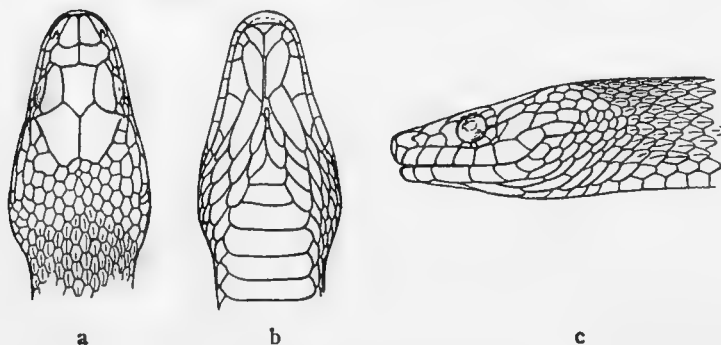


FIG. 21. *Natrix aequifasciata*. Nat. size. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 21037 from Futsing Hsien, Fukien.

The original description, based on two juvenile females, follows:

Eye rather large. Rostral broader than deep, just visible from above; internasals almost wedge-shaped, twice as long as broad, one and one-half times as long as prefrontals; frontal one and two-thirds as long as broad, as long as distance from end of the snout, shorter than the parietals; loreal as long as deep; two preoculars and two or three postoculars; one or two suboculars may be present,—these are very small and separated by the fifth upper labial. Temporals  $2 + 3$ ,—these may be broken into several scales; nine upper labials, the seventh largest and the fifth always entering orbit,—the fourth and sixth may do so also, or they may be excluded by the suboculars; five pairs of lower labials in contact with anterior chin-shields, which are a very little shorter than the posterior. Scales in nineteen rows strongly keeled, except the outer row, on which the carination is weak. Ventrals 148-151; anal divided; subcaudals 74-75.

Color (in alcohol) boldly banded with twenty or twenty-one black bars on the body and twelve on the tail. The interspaces narrower than the bars, but less narrow laterally than dorsally, white with a slight brownish tinge. Ventral surface ivory white, with black markings of the bars; these often end abruptly at the median line. The black blotches are roughly alternate.

The hemipenis is scarcely forked at the tip and extends to the ninth subcaudal plate. It is densely spinous with three enlarged basal spines or hooks set in a compact longitudinal row; proximally the first few spines are largest,

but they soon become relatively uniform in size and disposition, save for a gradual decrease in size toward the tip of the organ; the sulcus is not divided, its moderately prominent lips bearing numerous spines. (Description based on a Foochow specimen.)

*Distribution*.—*N. aequifasciata* is known only from Lohsiang in eastern Kwangsi; Tinghushan, Wuyung and Lofaoshan in mainland Kwangtung; Hainan; and Futsing Hsien, Foochow and Yenping in Fukien.

*Habits and Habitat*.—I described the habits and habitat preference of this snake as follows (1929, l.c.):

In strong contrast to *annularis* and *piscator* this species is a true inhabitant of mountain brooks. Even though I caught several and saw many that escaped me I never found one away from a stream. They were found either in the stream or basking on the bushes over the water into which they dropped when alarmed. Sometimes they dropped from a point ten or twelve feet above the water. After reaching the water they hid under stones on the bottom. Even though the brooks in which I observed these snakes flowed through flooded fields which, as well as the streams, were frequented by *piscator* and *annularis* I failed to find *aequifasciata* in the fields. This point is repeated for emphasis as it is interesting to note the tenacity with which this snake clings to its original habits.

The Futsing streams in which *aequifasciata* was so common were the open kind found in hills and low mountains and not the high, shaded cascade type. The snakes were taken at very nearly sea-level and are probably to be reckoned as inhabitants of more gently flowing, open country, rather than heavily shaded, cascading mountain watercourses. This does not mean that they never venture into the latter.

When annoyed *aequifasciata* gathers itself into irregular coils, often striking violently and hissing at each stroke. It might be called "snappy" or "pugnacious."

A small fish of the genus *Zacco* was found in the Foochow specimen.

Mell (1929, p. 53) states that *aequifasciata* occurs at from 40 to 500 meters altitude.

Fan (1931, l.c.) remarks that it gives off an offensive odor when handled.

*Material examined*.—I have seen the following material: the cotypes and a specimen from Lohsiang, in the Museum of Comparative Zoölogy; 1 from Yenping, in the U. S. National Museum; 12 from Fukien, in the American Museum; and 1 from Fukien, in the British Museum.

*Remarks*.—*Natrix annularis*, *percarinata*, and *aequifasciata* are sometimes so much alike that only careful study will serve to distinguish them. For example, there can be little doubt that Chang's (1932, p. 33) Szechwan record of *aequifasciata* is in reality based on *percarinata*.

#### 9. *Natrix annularis* (Hallowell)

Figure 22

*Tropidonotus annularis* Hallowell, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 151 (type locality, Ningpo).

*Tropidonotus chinensis* "Jan" Berthold, 1859, Nachrichten Ges. Wiss., Goettingen, p. 180 (type locality, China).

*Tropidonotus semifasciatus* Berthold, 1859, l.c. (alternative name).

*Tropidonotus habereri* Werner, 1904, Abh. Bayer Akad. Wiss., II Kl., XXII, p. 354, Col. Pl. 1 (type locality, Ningpo Mountains).

*Natrix annularis* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, pp. 67 and 68 (comparison with *piscator* and *percarinata*; recorded from Foochow and Kuliang, Fukien).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 508 (Wuhu and Ningkwo in Anhwei; Fukien).

*Description*.—Preoculars single; postoculars 3, very rarely 2; anterior temporals 2 or 3, very rarely 4; posterior temporals 2 or 3; scales keeled, 19-17, rarely reduced only to 18 before vent; ventrals in males 153-163, females 145-159; subcaudals in ten males 63-69, in eight females 58-61; dark bands on body in males 40-46, females 34-44; on tail in males 22-27, females 16-22. (Description based on twenty-four specimens from Fukien and northeastern Kiangsi.)

The relation of the upper labials to the eye for seventy-seven specimens in the American Museum is summarized in Table III, the middle figure of each formula indicating the number of labials entering the eye, the one on the left representing the number posterior, the one on the right those anterior to the one or ones entering it.

TABLE III. UPPER LABIAL FORMULAS OF *NATRIX ANNULARIS* FROM FUKIEN AND KIANGSI

Locality	Number of Specimens	Upper Labial Formula
Futsing Hsien. . . . .	5	4-1-4
Futsing Hsien. . . . .	6	4-1-3
Futsing Hsien. . . . .	4	4-1-4 on one side, 4-1-3 on the other
Hokow. . . . .	10	4-1-4
Hokow. . . . .	4	4-1-4 on one side in all; 4-1-3 on the other in three, 3-2-3 in one
Hokow. . . . .	1	Right 4-1-3, left 5-1-4
Yenping. . . . .	34	4-1-4
Yenping. . . . .	8	4-1-4 on one side in all; 4-1-3 on the other in six, 5-1-4 in one, 3-2-4 in one
Yenping. . . . .	1	Right 4-2-3, left 3-3-3
Chungan Hsien. . . . .	3	4-1-4
Chungan Hsien. . . . .	1	Right 4-1-3, left 4-1-4
Following specimens tabulated above: Nos. 33306-33348, 33830-33844, 33690-33693, 35060-35074		

The three largest females in a series of 104 specimens from Fukien and northeastern Kiangsi measure from snout to vent 552, 540, 510 mm., the three largest males from the same series 441, 440, 428 mm. (Pope, 1929, p. 393). In *annularis*, the males have a slightly higher ventral count, somewhat more numerous subcaudals and more dark bands, especially on the tail. They also develop tubercles on the anterior lower labials and chin-shields.

*N. annularis* attains a very large size in the Yangtze Valley. I examined a female from the Shanghai region that measured 825 mm. from snout to vent. Chang and Fang (1931, p. 255) give additional measurements of northern material, their largest male and female being 563 and 852 mm. in total length, respectively.

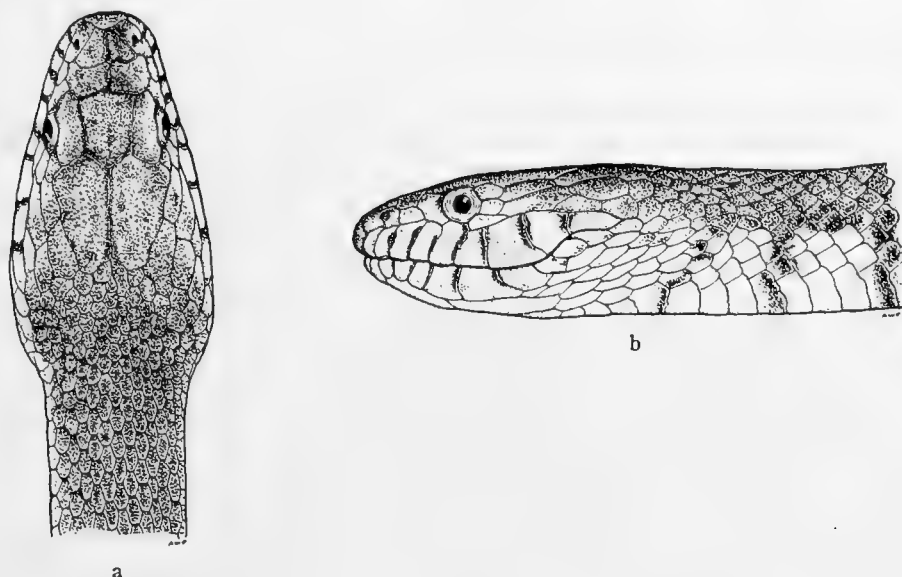


FIG. 22. *Natrix annularis*.  $\times 1\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 24597 from Ningkwo, Anhwei.

The original description, based on a single specimen the tail of which is imperfect, follows:

Nostrils between two plates; internasals long and narrow; a frenal; one antocular, three postocular plates; eight superior labials, the eye resting on the fourth; præanal scute bifid; scales very distinctly carinated, except the three inferior rows, which are smooth; color above ash; beneath yellow, with transverse dark colored blotches, arranged for the most part alternately, extending upon the sides; these blotches extend about half way across the abdomen; the broadest occupy two scales, the most narrow usually but one, and occasionally unite in the middle; 19 rows of scales; 159 abdom. scuta; 33 bifid sub-caudal. Total length 2 ft. 6½ inches (Fr.); length of tail 3 in. 8 lines.

The hemipenis extends to the ninth subcaudal plate and is scarcely if at all forked at the tip. It is densely spinous throughout. Proximally, the

spines are intermixed with short, inconspicuous, longitudinal ridges. There are three enlarged basal spines or hooks set in a compact, longitudinal row and, proximally, the first few spines are largest but they soon become relatively uniform in size and disposition, save for a gradual decrease in size toward the tip of the organ. The sulcus is unforked, its lips spinous and raised. (Description based on a specimen from Futsing Hsien.)

*Distribution*.—*N. annularis* has been secured with absolute certainty from the following Chinese localities:

Fukien: Futsing Hsien; Foochow; Kuliang; Yenping; Chungan Hsien.

Kiangsi: Hokow; Kiukiang and region.

Chekiang: Ningpo and region; a locality about 80 miles west of Ningpo; Wenchow; Lanchi.

Anhwei: Wuhu; Ningkwo.

Kiangsu: Shanghai region; Nanking.

*Natrix annularis* is well known on Formosa but it is extremely puzzling to find a typical male specimen with 156 ventrals and 67+ subcaudals from "Haut-Tonkin" in the Paris Museum because Mell (1931, p. 201) considers the species to be lacking in Kwangtung, while Fan (1931) does not record it from Kwangsi. Other eastern Chinese lowland forms occur in the higher altitudes of Tongking but in the present case I have no explanation for the apparent absence of *annularis* in Kwangtung and Kwangsi.

*Habits and Habitat*.—I found *annularis* abundant in the streams of the hills near Ningkwo and encountered it again in Fukien and described its habits there as follows (1929, p. 393):

*N. annularis* is common in Fukien from the coast up to the base of the high Kuatun range. Near Yenping it is extremely abundant even in the upper mountain valleys there. It does not frequent the shaded forest cascades but rather the irrigated fields and streams of the open valleys. It is abundant in the rice fields as in the stream beds and in this way its habits contrast with those of *N. aequifasciata* which seems to be confined to the latter. I never saw *annularis* drop from a bush into the water but often found it in level, open, highly cultivated rice fields far from shade or streams. Probably it was originally an inhabitant of hilly country streams and waterways but has now adapted itself to a rice-field life.

Five stomachs contained the remains of small loaches, four held remnants of eels of the genus *Fluta*, while in one stomach there were minnows and an eel head (*Fluta*). Frog remains were found in only two snakes. *N. annularis* thus shows a preference for fish over frogs, though certainly one class of food is as abundant as the other in the streams and flooded fields frequented by these snakes.

I have recently found a frog (*Rana nigromaculata*) in the stomach of a specimen collected near Shanghai and now preserved in the U. S. National Museum. Maki (1931, p. 37) states that *annularis* usually eats fishes.

Four females collected at Hokow between June 28 and July 12 hold 6, 6, 9

and 9 eggs, respectively, and are quite uniform in size, measuring 425-471 mm. from snout to vent. The embryos in all these eggs are still in very early stages of development and too small to be revealed by gross examination. A Futsing Hsien specimen measuring 413 mm. from snout to vent contains 5 slightly pigmented embryos, one of which is 120 mm. long. This female was collected between August 24 and October 5. A gravid specimen from Yenping contains only 4 eggs. The brief data given by me in 1929 (p. 393) are entirely included here. Chang and Fang (1931, l.c.) record 9-13 embryos in four specimens, respectively. On September 28, 1921, I encountered a female on the banks of a stream near Ningkwo giving birth to young. It produced 9 offspring but retained 4 more well-developed ones in its body. Two of the latter measure 195 and 210, the mother 775 mm., from snout to tip of tail. No egg-teeth are present on these infant snakes.

*Material examined*:—I have seen the following material: 90 specimens from Fukien, 31 from Anhwei, and 15 from northeastern Kiangsi, in the American Museum; 4 from the mountains "north" of Kiukiang, 2 from Ningpo and region, and 1 with no more definite locality than Chekiang, in the British Museum; 1 from "Haut-Tonkin," in the Paris Museum; 1 from Lanchi, in the Museum of Comparative Zoölogy; 2 from Kuliang, 1 from Foochow, 1 from Wenchow, and 2 from the Shanghai region, in the U. S. National Museum.

*Remarks*:—It is interesting to note that a comparison of sexual dimorphism in size, tail length and ventral and subcaudal counts as exhibited by the allied species, *annularis*, *percarinata* and *aequifasciata*, brings only one marked difference to light, i.e., male *annularis* alone have a higher average ventral count, there being no appreciable sexual distinction in this regard for the other two. This indicates closer relationship between *percarinata* and *aequifasciata* than between *annularis* and either of the others, an indication borne out by the striking similarity in the shape of the heads of *percarinata* and *aequifasciata*.

#### 10. *Natrix bitæniata* Wall

*Tropidonotus dipsas* Anderson, 1879, Zool. Res. W. Yunnan, p. 819 (part: Husa valley, Chanta, and Pangsi, all in western Yunnan).

*Tropidonotus parallelus* Boulenger, 1890, Fauna Brit. India, p. 345 (part: Upper Burma and Yunnan); 1893, Cat. Snakes Brit. Mus., I, p. 223, Pl. XIII (part: Husa valley and Chanta, western Yunnan).

*Natrix bitæniata* Wall, 1925, Journ. Bombay Nat. Hist. Soc., XXX, p. 806 (type localities, Kutkai, 4500 feet, Sinlum Kaba, 6000 feet, Sanda<sup>1</sup> and Yunnan: hereby restricted to Kutkai, North Shan States, Burma); 1926, XXXI, p. 560 (Huton, Upper Burma).

*Description*:—Upper labials 8, very rarely 7, normally 3rd, 4th and 5th entering orbit; preoculars 1 or 2, rarely 3; postoculars (in nine examples) 3, very rarely 2; anterior temporals 1 or 2; scales keeled, in 19 rows; ventrals

<sup>1</sup>Sanda (or Chanta) actually is in Yunnan but was confused by Wall with a locality on the Upper Chindwin.

160-175; subcaudals 78-95. (Description based on three examples from Huton; Boulenger's cotypes of *parallelus* "e" and "f"; Anderson's nine examples from Yunnan, 1879, p. 819.)

Wall (1925, p. 807) gives the number of maxillary teeth as 23.

The original description of the cotype from Kutkai, a male, follows:

Rostral, just visible from above, depth about three-fifths the breadth. Internasals, a pair, truncate anteriorly; the suture between them subequal to that between the praefrontals. Praefrontals, a pair; the suture between them about two-fifths the length of the frontal. Frontal, greater than its distance to the end of the snout; breadth, a shade more than twice that of the supraocular at mid orbit. Loreal, one. Praeocular, one. Postoculars, three. Temporals 2 + 1. Supralabials, 8; the 1st and 2nd touching the nasals, 3rd, 4th and 5th the eye; 6th and 7th the lower temporals. Posterior sublinguals, rather longer than the anterior; divergent posteriorly; touching the 5th, 6th and 7th infralabials; partially separated by two small azygos scales and one pair, after which is a narrow 1st ventral. Costals, two heads-lengths behind the head 19, midbody 19, two heads-lengths before the vent 17. Keeled to the penultimate row in midbody. Emarginate apically. No (?) apical facets. Ventrals, 164. Anal, divided. Subcaudals, 86 pairs.

*Distribution*.—*N. biteniata* inhabits extreme western Yunnan; the Kachin Hills; the North Shan Hills; and northern Tongking. It is therefore to be expected in extreme southwestern Yunnan.

*Habits and Habitat*.—This species is apparently a mountain inhabitant, for Wall (1925, p. 806) records it from 4500 and 6000 feet, and the altitude of Husa, where Anderson found it common, is 4500 (Davies, 1909, p. 402).

*Material examined*.—I have seen the following specimens: Wall's cotype from Kutkai; Boulenger's specimens "e" and "f" (1893, p. 223); 3 examples from Huton; and 1 from the Fansipan Mountains, Tongking. All the above material is in the British Museum. The American Museum has recently received one of the 3 Huton examples in exchange from the British Museum.

*Remarks*.—It is impossible to say just where to place Stanley's (1916, p. xv) record of *Tropidonotus parallelus* presumably from Yunnan. It is perhaps *biteniata*.

Wall (1925, l.c.) has explained in great detail as follows the differences between *biteniata* and *parallela*:

A small snake sent to me by Mr. P. M. R. Leonard from Kutkai, North Shan States (4,500 feet), which I at first took to be a specimen of *Rhabdophis parallelus* Boulenger, proves to be a very distinct species. I prepared the skull of a similar specimen from Sinlum Kaba, Kachin Hills (6,000 feet), and find that the maxillary dentition is syncranterian, whereas in *parallelus* from the Khasi Hills, Assam, the dentition is diacranterian. An examination of all the specimens, identified as *parallelus* in the Bombay collection and the Indian Museum, shows that those collected in the Eastern Himalayas and the Assam Hills agree with *parallelus* in dentition, whereas the specimens from Burma (Kachin Hills and North Shan Hills) and all those collected by Anderson in the Yunnan Expedition of 1868, conform to the type of



*biteniata*. Reference to Boulenger's Catalogue (vol. i, page 223), shows the author based his description of *parallelus* on six specimens from Sikkim, the Khasi Hills, Sanda<sup>1</sup> on the upper Irrawady (1,500 feet; Lat. 24° 30', Long. 95°), and the Hotha Valley, Yunnan, the two latter specimens being collected by Anderson during the Yunnan Expedition. It seems probable that the two last will be found to conform with *biteniata*, and that the remaining four only should be retained as types of *parallelus*. For many years I have been puzzled to know why Boulenger placed *parallelus* in the subgenus *Tropidonotus* (= *Natrix*), as my skulls from Khasi Hill and Sikkim specimens show the maxillary dentition to be diacranterian and conforming to the dentition of the genus *Rhabdophis*. The explanation seems to be that when examining the dentition he had before him one of Anderson's specimens.

I have now seen ten specimens of *biteniata*, seven of which are Anderson's Yunnan examples in the Indian Museum. I have notes on eighteen specimens of *parallelus* from the Eastern Himalayas, and Assam Hills.

I have critically examined, side by side, Anderson's seven examples with several specimens of *parallelus* from the Eastern Himalayas, and the Assam Hills. They are surprisingly alike. I can find no constant character in the lepidosis to distinguish one from the other, and the few differences in markings are trivial. Were it not for the marked difference in the maxillary dentition, nobody would suppose them different.

The differences noted by me are:—(1) In *parallelus* there is a dark præocular streak sometimes extending to the rostral. There is no such streak in *biteniata*. (2) The postocular streak in *parallelus* is not so broad, or so well defined as in *biteniata*, and is interrupted at the gape, i.e., not connected with the lateral black body stripe. In *biteniata* the postocular stripe is continuous with the lateral body stripe. (3) In *parallelus* the blackish lateral body stripe on the 3rd and 4th rows above the ventrals, is not so well defined or conspicuous as in *biteniata*. As regards lepidosis, in *parallelus* the anterior temporal shields are usually single, in *biteniata* usually two.

Finding myself unable, through lack of sufficient material, to determine definitely the relation between *biteniata*, *parallela* and *octolineata*, I am treating them as distinct species. I believe, however, that a thorough study will make it necessary to change this arrangement. *N. octolineata* appears to be little more than subspecifically distinct from *biteniata*, which, in spite of Wall's contentions, seems to be of uncertain status in relation to *parallela*. Material of *octolineata* from eastern Yunnan may be distinguished from *biteniata* by subcaudal counts as well as degree of carination, but the difference in number of subcaudals breaks down in *octolineata* from western Yunnan. On the whole, the latter species has a strong tendency to develop black pigment in the form of longitudinal stripes, while *biteniata* seems to be relatively free of such a tendency.

## 11. *Natrix chrysarga* (Schlegel)

### Plate VI, A and B

*Tropidonotus chrysargus* Schlegel, 1837, Phys. Serp., II, p. 312, Atlas, Pl. XII, figs. 6-7 (type locality, Java).

*Tropidonotus chrysargus* Boulenger, 1899, Proc. Zool. Soc. London, p. 957 (Wuchih Mts., Hainan) (part).

*Natrix chrysarga* Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 201 (Kaphao, Kachek River, Hainan, 200 meters).

<sup>1</sup>See footnote, p. 99.

*Description*.—Upper labials 8 or 9, 4th to 6th or 3rd to 5th entering orbit; 1 or 2 preoculars; 3 postoculars; 2 anterior and 2 or 3 posterior temporals; scales strongly keeled, in 19 rows; ventrals 140-176; subcaudals 56-94. Brown or olive-green above, usually with yellow spots or transverse bars along each side of back; upper labials with black sutures; a yellow angular or crescentic band on nape; yellow below, sometimes black-dotted and with black spots along either side; young with black transverse bars or black spotted; length of head and body 575 mm., tail 191 mm. (Description abstracted from de Rooij, 1917, p. 89.)

Three Hainan and two Hongkong specimens, all the properly identified Chinese material known to me, have 150-158 ventrals and 79-87 subcaudals. Hainan examples seem to lack the dark spots usually present laterally on the ventrals.

*Distribution*.—*N. chrysarga* is known only from Hainan and Hongkong (see remark in regard to this locality below) in China.

Distributed from southern Burma through the peninsula of southeastern Asia and the Malay Archipelago to Flores, Celebes, Borneo and Palawan.

*Habits and Habitat*.—In the East Indies this snake inhabits the vicinity of water in mountainous or hilly country. It feeds on frogs and fish (Mertens, 1930, p. 293, and Taylor, 1922, p. 89). The Hainan records by Smith (1923, p. 201) and Boulenger (1899, p. 957) confirm the preference of *chrysarga* for hilly or mountainous localities, while Smith's specimen was evidently taken in a thickly wooded region.

Meggitt (1931, p. 413) found insect remains in Burmese material but this does not prove that *chrysarga* eats insects since those in question might have been left over from digested frogs.

At Tjibodas, Java, *chrysarga* may lay from 4 to 7 more or less adherent eggs measuring from 23 to 31 x 11.5 to 15 mm.; the young hatch after two months' incubation and measure from 175 to 196 mm. The laying may take place in September and January (Kopstein, 1932, p. 79, fig. 2).

*Material examined*.—I have seen the following specimens from China including Hongkong: 2 from Hongkong and 1 from Hainan, in the Naturhistorisches Museum, Vienna; and 1 from the latter locality in the British Museum. Hongkong records are open to question more often than not, so it would be most gratifying to have confirmation of the presence of *chrysarga* on that island.

*Remarks*.—A juvenile example of *Natrix craspedogaster*, having 143 ventrals and 91 subcaudals and collected in Chekiang by Fortune, was recorded as *Tropidonotus junceus* by Guenther (1864, p. 268) and later as *T.*

*chrysargus* by Boulenger (1893, p. 259). It obviously forms the basis of Mell's (1931, p. 204) new subspecies, *N. chrysarga chekiangensis* described as having 143 ventrals and 91 subcaudals. I studied this specimen with great care and recounted its ventrals as 148 while working in the British Museum.

Steindachner's (1913, p. 359) Formosan examples of *T. chrysargus*, upon re-examination by me, have proved to be *N. piscator*. A specimen of *chrysarga* (Berlin Museum No. 30295) from "Taiping," collected by von Maltzahn, is assumed to be from Taiping, Formosa, but since there are numerous Taipings in China as well as one on Formosa, I think it is well to disregard this record entirely. My belief that *chrysarga* does not occur on Formosa is fully confirmed by Maki (1931) who does not even list the name in his index.

## 12. *Natrix craspedogaster* (Boulenger)

Plate VI, C, D and E

*Tropidonotus junceus* Guenther, 1864, Rept. Brit. India, p. 268 (part: Chekiang).

*Tropidonotus chrysargus* Boulenger, 1893, Cat. Snakes Brit. Mus., I, p. 259 (part: Chekiang).

*Tropidonotus craspedogaster* Boulenger, 1899, Proc. Zool. Soc. London, p. 163, Pl. xvii (type locality, Kuatun, Fukien).

*Tropidonotus gastrotaenia* Werner, 1922, Anz. Akad. Wiss. Wien, LIX, p. 221 (type locality, Yunshan near Wukang, southwestern Hunan, 1000-1200 meters); 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 45 (amplified description of type material).

*Natrix craspedogaster* Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 39, fig. 10 (Lung-chih, Omei Hsien, Szechwan, about 680 meters).

**Description:**—The number and arrangement of the labials, oculars and temporals are of great importance in distinguishing *craspedogaster* from the closely allied *sauteri* and *popei* so I have tabulated data on eleven specimens from Yenping and forty-nine from Chungan Hsien in the American Museum with results as follows:

### YENPING SERIES

Preoculars: 1-1 in ten, 3-3 in one.

Postoculars: 3-3 in all.

Anterior Temporals: 2-2 in eight, 1-1 in two, 2-3 in one.

Upper Labials: 3-3-2 in five, 3-2-3 in three, 3-3-3/3-3-2, 3-2-3/4-2-3 and 3-2-3/2-3-2 in one each.

Lower Labials: In every case 5 lower labials are in contact with the anterior chin-shields on both sides.

### CHUNGAN HSIEN SERIES

Preoculars: 1-1 in forty-eight, 1-2 in one.

Postoculars: 3-3 in forty-five, 3-4 in two, 3-2 and 4-4 in one each.

Anterior Temporals: 2-2 in thirty-three, 1-2 in five, 1-1 in four, 2-2 or 1-1 plus extra small scales in seven.

Upper Labials: 3-3-2 in thirty, 3-2-3 in four, 3-2-2 and 4-3-3 in one each, 3-3-2 on one side and 3-2-3, 3-3-3, 4-2-3(1) or 4-3-2(1) on the other in eleven, 3-3-3/3-2-3 and 4-3-2/4-2-3 in one each.

Lower Labials: in forty-one specimens 5 lower labials are in contact with the anterior chin-shields on both sides, in four 5 on one side 6 on the other, 6 on both sides in two, 4 on one side 5 on the other in one, and 4 on both sides in one.

In the above tabulation, the middle figure of the upper labial formula indicates the number of labials entering the eye, the one on the left represents the number posterior, the one on the right anterior to those entering it.

TABLE IV. VENTRAL AND SUBCAUDAL COUNTS OF *NATRIX CRASPEDOGASTER*

Locality	Sex	Ventrals	Subcaudals	Museum or Reference
Chekiang.....		148	91	Boulenger, 1893, p. 259 (ventrals given as 143)
Southern Fukien.....	♂	148	89	British Museum
Chungan Hsien.....	♂	(7)152-157	(5)89-100	Pope, 1929, p. 396
Chungan Hsien.....	♀	(6)150-156	(4)88-93	Pope, 1929, p. 396
Yenping.....	♂	(2)150-151	(1)96	Pope, 1929, p. 396
Yenping.....	♀	(2)147	(2)83-87	Pope, 1929, p. 396
Mountains near Yenping..	♂	(4)144-150	(2)91	Schmidt, 1927, p. 510
Mountains near Yenping..	♀		(2)82-89	Schmidt, 1927, p. 510
Northern Kwangtung.....	♂	150	94	Berlin Museum No. 27696
Pingsiang.....	♂	147	81	Naturhistorisches Museum, Vienna
Yunshan.....	♂ + ♀	(3)142-152		cotypes of <i>gastrotaenia</i> (tails incomplete in all)
Kweichow.....	♀	(3)145-149	(2)74-80	Paris Museum
Yunnan border south of Süchow.....	♀	148	93	U. S. Nat. Mus. No. 79893
Chouchiakou.....	♀	145		U. S. Nat. Mus. No. 80097
Chouchiakou.....	♂		97	U. S. Nat. Mus. No. 81507
Süchow.....	♀	(2)145-147	(1)87	U. S. Nat. Mus. Nos. 71569 and 71571
Süchow.....	♂	138		U. S. Nat. Mus. No. 71570
Süchow.....		141	95	U. S. Nat. Mus. No. 71572
Between Lungchih and Chinkouho.....	♀	144		U. S. Nat. Mus. No. 69932
Lungchih.....		159	92	Chang, 1932, p. 40
Yachow.....	♂		81	U. S. Nat. Mus. No. 76258

The figures in parentheses in Table IV represent the number of specimens on which the tabulated ventral and subcaudal counts were based.

The three largest males among sixty from Fukien measure from snout to vent 435, 419 and 391 mm., the three largest females 490, 481 and 478, respectively (Pope, 1929, p. 396).

The original description, based on six cotypes, follows:

Eye rather large. Rostral once and two thirds as broad as deep, scarcely visible from above; nasal completely divided; internasals shorter than the præfrontals; frontal once and two thirds as long as broad, longer than its distance from the end of the snout, shorter than the parietals; loreal as long as deep; one præocular; three postoculars; temporals 1 + 1, 2 + 1, or 2 + 2; eight upper labials, third, fourth, and fifth entering the eye; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 19 rows, dorsals rather strongly keeled, outer row faintly keeled. Ventrals 145-157; anal divided; subcaudals 87-97. Dark brown above, with a rusty-red streak along each side of the back, accompanied by more or less distinct yellowish spots; ill-defined black spots on the sides; labials yellowish, with black bars on the sutures; a short oblique yellow streak on each side of the nape, beginning on the last upper labial and directed backwards towards its fellow; yellowish beneath, with an elongate black spot near the outer extremity of each shield, forming a well-defined line on each side of the belly and tail. Total length 635 mm.; tail 185.

The hemipenis is forked at the tip and extends to the seventh subcaudal plate. It is spinous throughout and has a single very large basal spine or hook. The spines are relatively uniform in size but smaller near the tip of the organ and intermixed throughout with small, more or less distinct and continuous, longitudinal ridges. The sulcus is prominent, its lips raised and spinous. (Description based on a Chungan Hsien specimen.)

*Distribution*.—This species is known only from the following localities:

Chekiang: Taichow.

Fukien: Yenping and vicinity; Chungan Hsien (including Kuatun); southern Fukien.

Kwangtung: Chiufeng; Wanszushan.

Kiangsi: Pingsiang.

Hunan: Yunshan.

Kweichow: (no specific locality).

Szechwan: Yunnan border south of Süchow; Chouchiakou; Süchow; between Lungchih and Chinkouho; Lungchih; Yachow.

*Habits and Habitat*.—I found this snake common in the Yenping mountains and extremely abundant about Sanchiang and Kuatun in Chungan Hsien. Its normal habitat seems to be mountain forests above 1500 feet altitude. United States National Museum No. 79893 was collected at 6000 feet on the Yunnan-Szechwan boundary south of Süchow. The species is semi-aquatic.

Five Fukien adults had eaten young frogs or toads, while another had small tadpoles in its stomach, all of uncertain identity (Pope, 1929, l.c.).

A female from Chungan Hsien in the American Museum contains five well-developed eggs, one measuring 28 x 8.5 and another 31 x 9 mm.; they show no trace of embryos on gross examination. Two other females from the same locality contain five and seven eggs, respectively. These three snakes were collected between June 12 and July 20. A female from Yenping contains one large egg measuring 39 x 9 mm.; another, also from Yenping, holds five well-developed eggs. Most of these data have already been published by me (1929, p. 397). The species is probably oviparous.

*Material examined*:—I have seen the following specimens: 63 from Fukien and 1 from an uncertain locality, in the American Museum; 1 from southern Fukien, 1 from Chekiang and the type series, in the British Museum; 3 from Kweichow, in the Paris Museum; 3 from Hunan (cotypes of *gastrotaenia*) and 1 from Kiangsi (Pingsiang), in the Naturhistorisches Museum, Vienna; 2 from Fukien and 12 from Szechwan, in the U. S. National Museum.

*Remarks*:—Werner's *gastrotaenia* is based on three specimens none of which has a complete tail and hence his low subcaudal counts. Angel's (1920, p. 112) Kweichow material shows that *craspedogaster*, from the southwestern part of its range, has a rather low number of subcaudals (70-84) but the difference does not warrant the erection of a subspecies unless a large series proves it to be constant over a definite area. The Pingsiang example in Vienna has only 81 subcaudals.

The occurrence of this species together with *sauteri* in Szechwan deserves special notice. A field study of their respective habitats would be of great interest.

### 13. *Natrix johannis* (Boulenger)

Figure 23

*Tropidonotus johannis* Boulenger, 1908, Ann. Mag. Nat. Hist., (8) II, p. 244 (type locality, Yunnanfu).

*Natrix johannis* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 519, fig. 14 (Wutingchow District and Yunnanfu).

*Natrix nigroreticulata* Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 40, fig. 11 (type locality, Hsienhsiangchih, Omei Hsien, Szechwan, 2300 meters).

*Description*:—Upper labials 7 or 8, 3rd, 4th and 5th, 3rd and 4th or 4th and 5th entering orbit; 1 or 2 preoculars; 2, 3 or 4 postoculars; 1 or 2 anterior and 1 or 2 posterior temporals; scales 19-17, more or less keeled; ventrals 165-175; subcaudals 85-89; variable in color. (Description based on four examples from the type locality, including the type series, one from the Wutingchow region, Yunnan, and two from the Yalung valley, Szechwan.)

The original description, based on three specimens from the type locality, follows:

Eye rather small. Rostral not quite twice as broad as deep, just visible from above; internasals as long as broad, nearly as long as the præfrontals, much narrowed in front;

frontal once and one-third to once and a half as long as broad, as long as its distance from the end of the snout, much shorter than the parietals; loreal as long as deep or a little longer than deep; one or two præ- and three or four postoculars; temporals  $2 + 1$  or  $2 + 2$ ; eight upper labials, third, fourth, and fifth entering the eye; four or five lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 19 rows, dorsals feebly or faintly keeled, laterals smooth. Ventrals 165-170; anal divided; subcaudals 85-89. Olive-

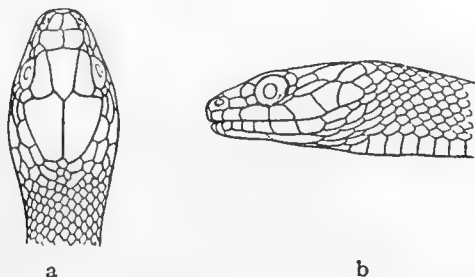


FIG. 23. *Natrix johannis*.  $\times 2$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 21076 from Yunnanfu.

brown above, with more or less distinct darker and lighter spots, the latter forming a lateral series or an ill-defined lateral streak; a curved yellowish streak may be present on each side of the nape; sutures between the labials blackish; ventrals and subcaudals yellow, with the ends olive-gray and bearing large black spots forming a lateral series. Total length 910 mm.; tail 210.

The hemipenis is spinous, shallowly forked at the tip and with a single large basal spine or hook. (Description based on a Yunnanfu example.)

*Distribution*.—*N. johannis* is known from Yunnanfu and the region of Wutingchow in Yunnan; the Yalung valley (Luningying, 2000 meters) and Omei Hsien in Szechwan (*nigroreticulata*).

*Habits and Habitat*.—All the records indicate that this snake lives at an altitude of 6000 feet or more. The type of *nigroreticulata* was taken in a forest and the Yalung valley specimens in all probability were also collected in a similar habitat (Despax, 1913, p. 179). This, of course, does not mean that *johannis* is found only in forests.

One of Boulenger's type series holds well-developed eggs with embryos still in very early stages of development, so *johannis* almost certainly is oviparous. I found several loaches in the stomach of this same female, while American Museum No. 12808 has the remains of a loach of the genus *Misgurnus* in its stomach.

*Material examined*.—I have seen the type series, in the British Museum; 2 Szechwan examples (Luningying), in the Paris Museum; and 2 from Yunnan, in the American Museum.

*Remarks*.—I think there can be little doubt that Chang's *nigroreticulata* is identical with *johannis*.

Smith (1921, p. 426) has identified some snakes from the Langbian Plateau, southern Annam, as *johannis*. I have studied his specimens carefully and believe that they represent some other species. (See p. 90.)

#### 14. *Natrix nuchalis* (Boulenger)

Figure 24

*Tropidonotus swinhonis* Guenther, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 221 (Ichang, Hupeh) (not of Guenther, 1868).

*Tropidonotus nuchalis* Boulenger, 1891, Ann. Mag. Nat. Hist., (6) VII, p. 281 (type locality, Ichang).

*Natrix leonardi* Wall, 1923, Journ. Bombay Nat. Hist. Soc., XXIX, p. 466 (type locality, Sinlum Kaba, Burma, about 6000 feet).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 512 (Tengyueh, Yunnan).

*Natrix nivalis* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 3 (type locality, Snow Mountain, north of Likiang, Yunnan, 13,000 [not 9000] feet); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 513 (amplified description of type; 2 Likiang paratypes described and erroneously recorded from the type locality).

*Tropidonotus nuchalis collaris* Vogt, 1927, Zool. Anz., LXIX, p. 283 (type locality, [Yunnan] South China).

*Natrix swinhonis nuchalis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 203.

*Natrix swinhonis* Mell, l.c. (not of Guenther, 1868).

*Natrix swinhonis reducta* Mell, l.c.

*Natrix swinhonis leonardi* Mell, l.c.

*Description*.—The upper labials are characteristic in this snake, showing a strong tendency to vary and to be reduced in number. They range from 3 to 7, one behind the eye nearly always being more or less elongate. Normally there are 2 anterior to the eye, 2 entering, and 1 or 2 posterior to it. This great amount of variation apparently cannot be correlated with distribution in China but, when more data are available on material from Burma and Tongking, some geographical variation may become evident. For the present it must suffice to show the relation of the eye to the labials in a large series of Chinese specimens. In Table V the middle figure of each formula indicates the number of labials entering the eye; the one on the left represents the number posterior, that on the right anterior to the one or ones entering it.

The anterior temporals are invariably single.

Parker (1925, p. 296) has shown that the scale formula varies from 18-19-17-15 to 14-15-13, the higher counts being usual in the southern part of its range. The even count on the neck is due to the nuchal groove. The middorsal scale row is dropped on the neck, the groove being simply the space ordinarily occupied by this median row.

The young often have a very conspicuous nuchal collar and this led Vogt to describe *N. nuchalis collaris* from immature material.

The females may attain a length of 700 mm. from snout to vent, but such dimensions are unusual. Males never reach such a size.

The original description, based on the four female cotypes, follows:



Head as in *T. natrix*. Eye moderate. Rostral broader than deep, just visible from above; internasals as long as broad or a little broader, as long as the præfrontals; frontal once and one third to once and a half as long as broad, as long as or longer than its distance from the end of the snout, a little shorter than the parietals; loreal as long as deep or deeper than long;

TABLE V. UPPER LABIAL FORMULAS OF *NATRIX NUCHALIS* FROM CHINA AND BURMA

Locality	No. of Speci- mens	Upper Labial Formula	Museum or Reference
Sinlum Kaba.....	1	3-2-2	Type of <i>leonardi</i>
Yunnan.....	25	1-2-2	In Series No. 28942, Berlin Museum
Yunnan.....	1	1-1-2	In Series No. 28942, Berlin Museum
Yunnan.....	3	1-1-3	In Series No. 28942, Berlin Museum
Yunnan.....	1	1-1- $\frac{2}{1}$	In Series No. 28942, Berlin Museum
Yunnan.....	1	$\frac{2-2-1}{\text{irregular}}$	In Series No. 28942, Berlin Museum
Yunnan.....	1	2-2- $\frac{1}{2}$	In Series No. 28942, Berlin Museum
Yunnan.....	1	$\frac{3}{2}$ -2-2	In Series No. 28942, Berlin Museum
Yunnan.....	1	2-2-2	Type of <i>collaris</i>
Yunnan.....	1	$\frac{1}{2}$ -2-2	Naturhistorisches Museum, Vienna
Yunnan.....	1	1-2-2	Naturhistorisches Museum, Vienna
Yunnanfu.....	1	1-1-2	American Museum No. 9124
Yunnanfu and 20 miles north	2	1-2-2	American Museum Nos. 17710 and 18079
Wutingchow.....	1	1-2-2	American Museum No. 12805
Tengyueh.....	4	2-2-2	American Museum Nos. 21061-62, 21068-69
Snow Mountain.....	1	2- $\frac{2}{1}$ -1	Type of <i>nivalis</i>
Likiang.....	1	2-2-2	American Museum No. 21025
Between Yungning, Yungpeh and Likiang.....	6	1-2-2	Naturhistorisches Museum, Vienna
Between Yungning, Yungpeh and Likiang.....	2	1-1-2	Naturhistorisches Museum, Vienna
Chiulung Hsien.....	1	1-2-2	U. S. Nat. Mus. No. 82817
Szechwan.....	3	1-2-2	U. S. Nat. Mus. Nos. 69939-940, 76256
Szechwan.....	2	2-2-2	U. S. Nat. Mus. Nos. 69942 and 76255
Süchow.....	1	2-2-2	U. S. Nat. Mus. No. 69941
Washan Region.....	1	2-2-2	U. S. Nat. Mus. No. 69930
Mt. Omei.....	7	1-2-2	U. S. Nat. Mus. Nos. 64431, 65501, 65503-04, 66645, and 79904-05
Mt. Omei.....	1	1-2- $\frac{3}{2}$	Chang, 1932, p. 44
Mt. Omei.....	1	1-1-3	Chang, 1932, p. 44
Mt. Omei.....	1	$\frac{2}{1}$ -1- $\frac{2}{3}$	Chang, 1932, p. 44
Muping Region.....	2	1-2-2	U. S. Nat. Mus. Nos. 79721-722
Ichang.....	6	2-2-2	Cotypes of <i>nuchalis</i>

one præ- and two or three postoculars; temporals  $1 + 1$  or  $1 + 2$ ; six upper labials, third and fourth entering the eye, fifth very long; four lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales feebly keeled, of outer row smooth, in fifteen rows. A very distinct groove along the middle of the nape. Ventrals 154-165; anal divided; subcaudals 46-50. Olive above, uniform or with small black spots; an oblique black line below the eye and another between the last two labials; lower parts uniform black, or black in the middle and olive on the sides. Total length 640 mm.; tail 120.

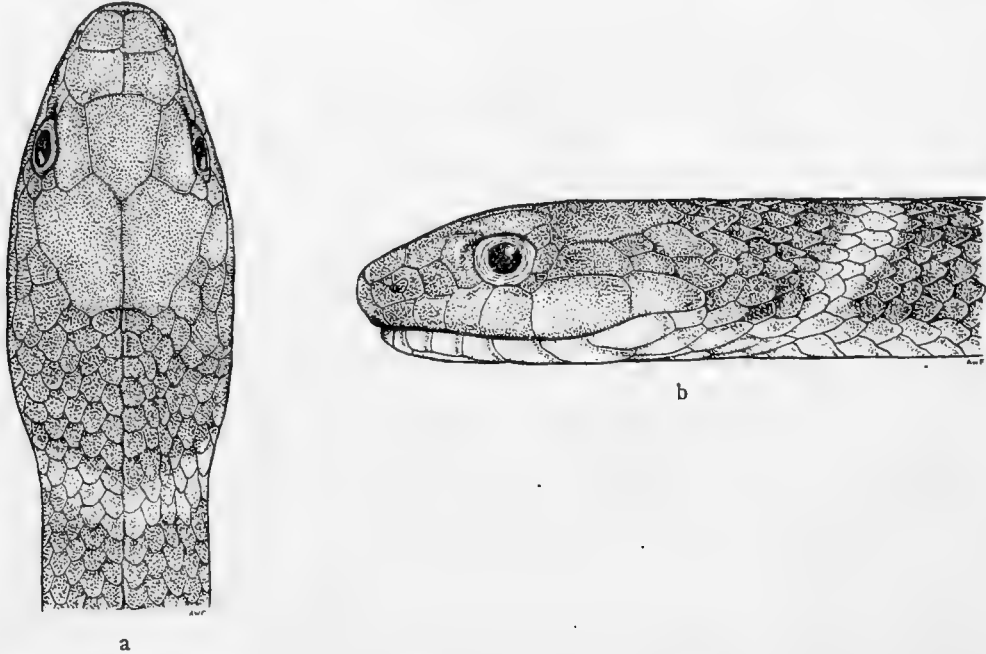


FIG. 24. *Natrix nuchalis*.  $\times 2\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 21069 from Tengyueh, Yunnan.

The hemipenis is shallowly forked, and unusual in possessing spines that arise from within plain-edged calyces save at the tip of the organ where there are no spines. The sulcus is prominent with well-developed lips. (Description based on a Tengyueh example.)

*Distribution*.—*N. nuchalis* is known from the following localities in China:

Yunnan: Kutsing; Yunnanfu; 20 miles north of Yunnanfu; Wutingchow; Tungchwan; Tengyueh; Tali; Snow Mountain; Likang; between Yungning, Yungpeh and Likang.

Hsikang: Chiulung Hsien, 10,500 feet.

Szechwan: Süchow; Washan region, 5000-8000 feet, U. S. Nat. Mus. No. 69930; Mt. Omei; Yaochi, near Muping, 7400-8600 feet, U. S. Nat. Mus. Nos. 79721-722; Muping region, 5000 feet, U. S. Nat. Mus. No. 79723.

Hupeh: Ichang.

It is also known from Burma (Sinlum Kaba) as well as Tongking (Ngoi-

Tio) and has recently been recorded from the Burma-Tibet frontier (Smith, 1932, p. 479).

*Habits and Habitat*.—This snake is obviously an inhabitant of high elevations in western China as shown by the altitude records already given. Wall (1925, p. 809) believes that it is not found below 5000 feet in northeastern Burma.

Judging by the large series in more than one museum, it is a very abundant species.

Two specimens in the American Museum from 20 miles north of Yunnanfu, one measuring 520 mm. in total length, the other a juvenile, contain remains of earthworms, while a slug was found in the stomach of a Tengyueh example also in the American Museum.

Some conception of the breeding habits of *nuchalis* may be gained by the following data also based on American Museum material: three Tengyueh specimens 659, 530 and 518 mm. in total length contain, respectively, 19, 11 and 9 eggs without embryos large enough to be revealed by gross examination. The largest specimen was collected May 17, the other two April 27. The eggs appear to be in only moderately advanced stages of development and one from each of the three lots measures, respectively, 11 x 5, 13 x 6 and 12 x 6 mm.

*Material examined*.—I have seen all the material listed in the table except the three Mt. Omei examples credited to Chang (1932, p. 44), and in addition to these, the following specimens from China: 2 from Yunnanfu, 5 from Kutsing, 1 from Wutingchow and 6 from Tungchwan, in the British Museum; several from Tali (Mell collection) and 1 from Yunnan, in the Berlin Museum; 1 from the Muping region, in the U. S. National Museum; and 1 from 20 miles north of Yunnanfu, in the American Museum.

*Remarks*.—*N. nuchalis* has been the subject of much discussion. After Wall described *leonardi*, Parker (1925, p. 296) studied a lot of material and concluded that *leonardi* is only a synonym of *nuchalis*, which varies somewhat irregularly in its scale formula. Later, Wall (1925, p. 808) concurred in this opinion. Mell, however, went to the opposite extreme, splitting *nuchalis* into a lot of forms and treating it as a subspecies of the Formosan *swinhonis*. Schmidt (1927, p. 512) also believed that it could be divided into good forms. I cannot agree with Mell in his extreme subdivision any more than in his aligning it as a subspecies of *swinhonis*, which is obviously allied but amply distinct as a species. Further confirmation of the specific distinctness of *nuchalis* and *swinhonis* is found in their respective distributions, for most of the species common to Formosa and western China also occur in Kwangtung. Mell (1922, p. 115) failed to find *nuchalis* in Kwangtung (his 1922 record for

that province being based on a specimen of *N. popei*, as he has himself told me in conversation) nor did Fan (1931) report it from Yaoshan in eastern Kwangsi.

In spite of the fact that I am following Wall and Parker, I do not consider this matter entirely settled and would not be surprised to see *nuchalis* justifiably divided into two good geographical subspecies, one northern and the other southern. Although, as shown by the accompanying table, I have abundant data on the labials of Chinese material, I have none whatsoever on specimens from Tongking and almost none on any from Burma, so I have been unable to check the labial variations against those of the scale rows graphically illustrated by Parker (1925, l.c.).

15. *Natrix octolineata* (Boulenger)

Figure 25

- Tropidonotus quadrilineatus* Boulenger, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 132 (type locality, Yunnanfu district).  
*Tropidonotus octolineatus* Boulenger, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 133 (type locality, Yunnanfu district).  
*Tropidonotus pleurotania* Boulenger, 1904, l.c. (type locality, Yunnanfu district).—Werner, 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 44 (Yunnanfu; and between Yungning, Yungpeh and Likang, Yunnan).  
*Tropidonotus parallelus* var. *sublavis* Despax, 1913, Bull. Mus. Hist. Nat., Paris, XIX, p. 180 (type locality, Mienning, Szechwan, 2000 meters).  
*Tropidonotus parallelus* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 115 (commonest snake from Yunnanfu to Tali) (not of Boulenger, 1890).—Vogt, 1927, Zool. Anz., LXIX, p. 283 (southern China) (not of Boulenger, 1890).  
*Tropidonotus parallelus* Vogt, 1924, Zool. Anz., LX, p. 339 (Washan, Szechwan) (typ. err. for *parallelus*; not of Boulenger, 1890).  
*Natrix septemlineata* Schmidt, 1925, Amer. Mus. Novitates, No. 175, p. 2 (type locality, Tengyueh, Yunnan); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 517, fig. 13 (amplified description of type).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 401 (Hsinkai, Yunnan).  
*Natrix parallela* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 516 (Likang, Yunnan) (not of Boulenger, 1890).  
*Natrix octolineata* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 517, fig. 12 (Tungchwan, Yunnan).

*Description*.—Upper labials 8, rarely 9, very rarely 7, 4th and 5th, occasionally 3rd, 4th and 5th, rarely 4th, 5th and 6th, very rarely 3rd and 4th, entering orbit but always 3 posterior to those entering orbit; preoculars single; postoculars 3, very rarely 2 or 4; anterior temporals 2, rarely 1; ventrals in six males 151-164, in five females 151-161; subcaudals in five males 64-77, in three females 61-73. (Description based on five examples from Yunnanfu, four from Tungchwan and five from Kutsing.)

The largest specimen in the collection of the British Museum measures 780 mm. in total length.

The original description, based on the type specimen, a female, follows:

Eye moderate. Rostral broader than deep, just visible from above; internasals broadly truncate anteriorly, as long as broad, nearly as long as the præfrontals; frontal once and a half as long as broad, a little longer than its distance from the end of the snout, much shorter than the parietals; loreal as long as deep; one præ- and two postoculars; temporals 2 + 2;

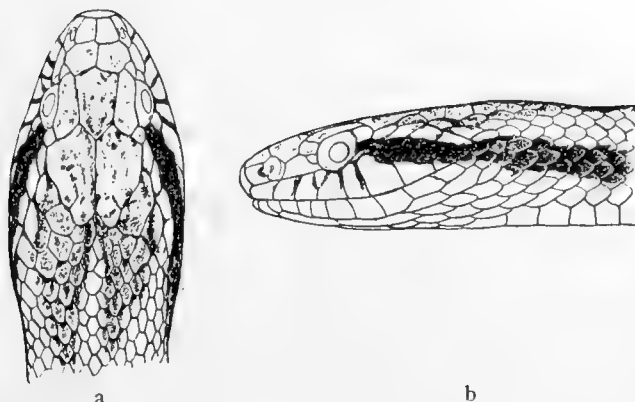


FIG. 25. *Natrix octolineata*.  $\times 1\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 13595 from Tungchwan, Yunnan.

nine upper labials, fourth, fifth, and sixth entering the eye; five lower labials in contact with the anterior chin-shields, which are a little shorter than the posterior. Scales in 19 rows, dorsals moderately keeled, laterals feebly, outer row smooth. Ventrals 152; anal divided; subcaudals 58. Pale grayish brown above, with two black longitudinal lines, separated by five series of scales, these lines widening on the nape and passing into the dark brown color of the upper surface of the head; a black lateral band extending from the eye to the end of the tail; a black zigzag lateral line, formed by the outer edges of the ventral shields; an interrupted black line on each side of the belly, formed by a short streak on each shield; upper lip and lower parts yellow, the outer ends of the ventral shields reddish; black spots or vertical bars on the upper lip. Total length 610 mm.; tail 125.

The hemipenis extends to the eighth to ninth subcaudal plates and is forked opposite the sixth to seventh. It is profusely spinous throughout and has a single enlarged basal spine or hook. Proximal to as well as opposite this hook the spines are small, but just distal to it they increase in size and become sharply recurved, while many of them are noticeably compressed. A short distance distal to the hook, the spines become smaller and less recurved again and continue so to the end of the organ without much further reduction in size. On the opposite side of the sulcus from the basal hook, a low, partly fleshy and partly spinous ridge extends longitudinally for a short distance. The lips of the sulcus are prominent and spinous proximal to the point of forking. (Description based on a specimen from Hsinkai.)

*Distribution*.—This species, as considered here, inhabits the Yunnan plateau where it has been recorded from Hsinkai; Yunnanfu; Tali; Likiang and region; Tungchwan; and Kutsing. It apparently extends its range well northward into Szechwan as far as Washan and Mienning.

To the west of the region outlined above, *octolineata* has been taken at Tengyueh (*septemlineata*) but I believe that west of the Yunnan plateau it is confined to high altitudes in the mountains.

*Habits and Habitat*.—Mell (1922, p. 115) described this species as the commonest snake of the open and cultivated land from Yunnanfu to Tali and this bears out my conviction that it inhabits the Yunnan plateau to the exclusion of *parallela* and *biteniata*, two amply distinct species from regions west of central Yunnan.

Fish were found in two Likiang specimens, a frog (*Rana*) in one from Hsinkai (Schmidt, 1927, p. 517, and Pope, 1929, p. 401). These stomach contents of American Museum material are supplemented by data on two specimens examined in the British Museum, one of which contained several small fish, the other, a Tungchwan example, a frog. These food data indicate aquatic habits.

*Material examined*.—I have seen the following material: the types of *quadrilineatus*, *octolineatus* and *pleurotænia*, and 14 additional specimens from the Yunnan plateau, in the British Museum; the 5 cotypes of *sublævis*, in the Paris Museum; 29 specimens from Yunnan, including 10 from Tali, in the Berlin Museum; a large series from between Yungning, Yungpeh and Likiang, and 1 example each from Yunnan and Yunnanfu, in the Naturhistorisches Museum, Vienna; 1 specimen each from Tungchwan, Yunnan and Yunnanfu, in the Museum of Comparative Zoölogy; 2 from the region of Washan, in the U. S. National Museum; and the type and 2 paratypes of *septemlineata* from Tengyueh; 2 specimens from Likiang and 1 each from Tungchwan and Hsinkai, in the American Museum.

*Remarks*.—There can be no doubt that Boulenger's three species of *Natrix*, namely, *quadrilineata*, *octolineata*, and *pleurotænia*, described in 1904 from the Yunnanfu district and based on three individuals from the same collection, represent a single species. The type of the first is a male with an obviously abnormal tail having some entire subcaudals and a subcaudal count too low for the species as it is now defined. The anal, although described as entire, is partly divided. Such an unusual anal alone strongly suggests an abnormal condition. I have rejected the term *quadrilineata* because it is based on this defective specimen and *octolineata* necessarily becomes the name of the species. This is most fortunate because, as might be expected, *quadrilineata* has not been applied to any material but the type, while such is not true of *octolineata*. The differences between the types of *pleurotænia* and *octolineata* fall within the range of individual variation of the species.

#### 16. *Natrix ornaticeps* (Werner)

Figure 26

*Tropidonotus ornaticeps* Werner, 1924, Sitzber. Akad. Wiss. Wien (math.-natur.), CXXXIII, Abt. I, p. 30 (type locality, northern Hainan).

*Natrix andrewsi* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 2 (type locality, mountains south of Nodoo,

Hainan); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 436, fig. 15 (amplified description of type).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 62 (Lohsiang, Kwangsi).  
*Macropophis ornaticeps* Mell, 1931, Lingnan Sci. Journ., VIII, p. 204.

*Description*.—Upper labials 9, 4th, 5th and 6th entering orbit; preoculars single; postoculars 4, occasionally 3; anterior temporals 2, occasionally 1; posterior temporals 3, occasionally 2; scales 19-17, heavily keeled; ventrals in three males 158-165, in two females 157-164; subcaudals in three males 116-119, in one female 118; total length of males 568+285, 560+278 and 556+282, females 570+?, 497+303 mm. (Description based on four specimens from Lohsiang and the type of *andrewsi* from Hainan, a female, the sex given in its original description notwithstanding.)

Fan (1931, p. 62) gives the number of maxillary teeth for a Lohsiang example as 28, while Schmidt counted 37 on the type of *andrewsi*. This character should be checked on additional material because I find 45 teeth on the right maxillary of the *andrewsi* type (left maxillary missing).

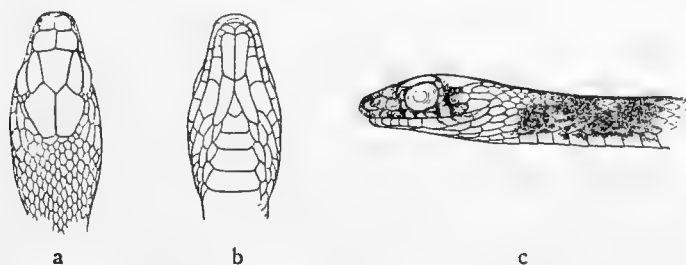


FIG. 26. *Natrix ornaticeps*. x 2. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 28255 from the mountains south of Nodoo, Hainan.

A translation of the original description based on the type specimen, a female, follows:

Scales in 19 rows, all, including those of the outer row, strongly keeled. Ventrals 168, anal divided, subcaudals 121 pairs. Rostral almost twice as broad as high, the portion visible from above a third of its distance from the frontal. Internasals as long as broad, broadly truncate anteriorly, as long as the prefrontals. Frontal one and a third times as long as broad, longer than its distance from the tip of the snout, shorter than the parietals. Nasal and nostril large, likewise the loreal, which is about as high as long; one preocular, 4 postoculars; 9 supralabials, the 4th to 6th entering the eye; temporals 2 + 2; 5 sublabials in contact with the anterior chin-shields, the latter little shorter than the posterior, both much elongated.

Sides of the head brown; a vertical white stripe, black-bordered on each side, on the preocular and the 4th supralabial; a similar vertical stripe on the postoculars and the 7th supralabial. The upper side of the neck region with three rows of alternating, large black spots; farther back the middle row is accompanied by a row of whitish spots; on the posterior two-thirds of the body the dorsal spots become fused into a longitudinal grayish-black band ( $\frac{1}{2} + 5 + \frac{1}{2}$  scale rows wide); sides of the body light brown, ventral surface whitish. Length 840 mm., tail 280 mm.

*Distribution*.—*N. ornaticeps* is known only from Hainan and eastern Kwangsi (Lohsiang).

*Habits and Habitat*.—This snake possibly is an inhabitant of mountain streams.

*Material examined*.—I have seen the type of *ornaticeps* and that of *andrewsi*, the only known Hainan specimens.

*Remarks*.—This rather characteristic species does not have any close ally in the Chinese region, its nearest relative being, apparently, *N. dendrophiceps* of the Philippines (Mindanao and Negros). A study of its life history would be of great interest.

#### 17. *Natrix percarinata* (Boulenger)

Plate VI, F and G

*Tropidonotus trianguligerus* Müller, 1881, Verh. Naturf. Ges. Basel, VII, p. 169 (Chonglok, Kwangtung) (not of Boie, 1827).

*Tropidonotus percarinatus* Boulenger, 1899, Proc. Zool. Soc. London, p. 163, Pl. xvii (type locality, Kuatun, Fukien).

*Natrix annularis* Barbour, 1912, Mem. Mus. Comp. Zool., XL, p. 130 (Ichang) (not of Hallowell, 1856).

*Tropidonotus annularis* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 116 (part: Tali, Yunnan, and northern Kwangtung).—Vogt, 1924, Zool. Anz., LX, p. 339 (Kwanhsien, Szechwan) (not of Hallowell 1856).

*Natrix percarinatus* Parker, 1925, Ann. Mag. Nat. Hist., (9) XV, pp. 302 and 304 (Thai-Nien, 300 feet, and Ngoi-Tio, 4500-6500 feet, Tongking).

*Natrix percarinata* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 71 (Mount Omei, Szechwan).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 52 (Lohsiang, Kwangsi).—Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 35, fig. 9 (the Hot Spring of Chungking, about 1000 meters, and Laochaitze of Hochuan, about 500 meters, eastern Szechwan).

*Natrix aequifasciata* Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 33 (Chingchengshan, near Kwanhsien, Szechwan, 1250 meters) (not of Barbour, 1908).

*Description*.—Upper labials 9, rarely 8 or 10; preoculars single; postoculars 4, occasionally 3 or 5; anterior temporals 3, occasionally 2 or 4; posterior temporals 3, occasionally 2, rarely 4; scales keeled, 19-17; ventrals 138-143, the sexes having the same average; subcaudals in eight males 70-79, in six females 67-73. (Description based on eighteen specimens from Fukien.)

The ventral range in a series of twenty-four examples from Lohsiang is 135-143, the subcaudal in fifteen from the same locality 68-79 (Fan, 1931, p. 55).

The relation of the upper labials to the eye for sixty-five specimens in the American Museum is summarized by formula in Table VI, the middle figure of each formula indicating the number of labials entering the eye, the one on the left representing the number posterior, the one on the right anterior to those entering it.

The three largest females among 106 from Fukien measure 730, 645 and 620 mm. from snout to vent, the three largest males of the same series 567, 524 and 515 mm. (Pope, 1929, p. 395). These figures show that the females



TABLE VI. UPPER LABIAL FORMULAS OF *NATRIX PERCARINATA* FROM FUKIEN AND SZECHWAN

Locality	Number of Specimens	Upper Labial Formula
Yenchingkou . . . . .	1	4-2-3
Chungan Hsien . . . . .	31	4-2-3
Chungan Hsien . . . . .	6	Each 4-2-3 on one side, 3-2-2, 3-2-3, 4-2-2, or 4-2-4 on the other
Yenping . . . . .	17	4-2-3
Yenping . . . . .	1	3-3-3
Yenping . . . . .	3	Each 4-2-3 on one side, 3-2-3 or 3-3-3 on the other
Futsing Hsien . . . . .	5	4-2-3
Futsing Hsien . . . . .	1	Right 4-2-3, left 3-2-3
Following specimens tabulated above: Nos. 23499, 33366-33386, 33653-33689, 33824-33829		

exceed the males in size. The females do not have a higher average ventral count than the males, while the latter have only a little higher average subcaudal count. A sexual difference is found in the tubercles of the chin-shields and anterior lower labials of the males (Pope, 1929, p. 394).

The dorsal bands may be very obscure, while the ventrum is often almost entirely devoid of bands, a condition most frequently seen in specimens from Ngoi-Tio, Tongking. I have already (1929, p. 394) pointed out that in *percarinata* the dark ventral bars fail to meet on the first few dozen ventral plates, while in *annularis* they unite in the midline almost up to the head and subsequent examination of additional material has served to substantiate this rule. *N. annularis* never shows the strong tendency, so prevalent in *percarinata*, to reduce the ventral bands.

The original description, based on a single male specimen, follows:

Eye moderate. Rostral twice as broad as deep, just visible from above; nasal completely divided; internasals much longer than broad, much narrowed anteriorly, longer than the præfrontals; frontal once and three fifths as long as broad, as long as its distance from the end of the snout, a little shorter than the parietals; loreal as long as deep; one præocular; three postoculars + one very small subocular; temporals 2 + 3; eight upper labials, fourth and fifth entering the eye; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 19 rows, all keeled, dorsals very strongly. Ventrals 141; anal divided; subcaudals 71. Greyish olive above, sides with light-edged black vertical bars; the four anterior upper labials greyish olive like the upper surface of the head, the rest uniform

yellowish white like the lower surface; belly uniform yellowish white anteriorly, spotted and speckled with blackish posteriorly; lower surface of tail dark grey, with some black spots. Total length 500 mm.; tail 130.

The hemipenis extends to the seventh to eighth subcaudal plates and is scarcely if at all forked at the tip. It is densely spinous, the spines intermixed with inconspicuous, more or less continuous, longitudinal fleshy ridges. There are three enlarged basal spines or hooks set in a compact, longitudinal row and proximally the first few spines are largest but they soon become relatively uniform in size and disposition, save for a gradual decrease in size toward the tip of the organ. The sulcus is unforked, its lips spinous and somewhat raised. (Description based on a specimen from Fukien.)

*Distribution*.—*N. percarinata* has been secured from the following Chinese localities with absolute certainty:

Chekiang: Ningpo Mountains; Tunghu.

Kiangsi: Pingsiang.

Fukien: Kuatun; Sanchiang; Yenping; Kuliang; Futsing Hsien; southern Fukien.

Kwangtung: numerous unspecified localities in the north; Chonglok.

Hainan: Kaphao.

Kwangsi: Lohsiang.

Kweichow: Hwangtsaopa.

Szechwan: Mount Omei; Yachow and region; Süchow; Kwanhsien and region; Chungking Hot Spring; Laosaitze of Hochuan; Yenchingkou near Wanhhsien; Chou-chiakou.

Hupei: Ichang.

Mell (1922, p. 116) records this species from Tali, Yunnan, but I would like to await confirmation of his record because so many collectors have failed to secure it in that part of Yunnan. I would also like to secure confirmation of the Shantung (Tsingtao) record based on a specimen collected by Kreyenberg (see also *Enhydris chinensis*).

I have been very conservative in compiling the above list because *percarinata* is so easily confused with both *annularis* and *aequifasciata*.

*N. percarinata* extends its range through Kwangtung and Kwangsi into Tongking and even Annam. It also occurs on Formosa where Maki (1931, p. 38) has named it as a new species, *suriki*. His data, though based on a small series, indicate that the ventral counts of Formosan specimens may warrant their recognition as a subspecies. His extremes are 142 to 153 for six individuals.

*Habits and Habitat*.—This species is an inhabitant of watercourses in forested mountains. It is extremely abundant in the cascading streams about Sanchiang and Kuatun and literally swarms in the few irrigated fields at the former village. In Futsing Hsien, it occurs wherever shaded mountain streams

afford it a suitable habitat even though these streams descend to within a few hundred feet of sea-level. I have never seen one sunning itself on vegetation over water. Mell (1922, p. 116) gives its vertical range in northern Kwangtung, where he found it to be abundant, as 300 to 900 meters, and U. S. National Museum Nos. 65455 and 66635 were collected as high as 6000 feet on Mt. Omei at Szuchiping.

In 1929 (p. 395), I reported on finding frog remains in seven, tadpoles in three, crayfish in one and loach in two stomachs of Fukien specimens, and can now add an eel (*Fluta alba*) to the list of animals eaten by *percarinata* (stomach of American Museum No. 23491 from Fukien).

On August 31 I secured at Kuatun 10 *percarinata* eggs, all white in color. The eggs were opened on September 12 and found to contain well-pigmented embryos, one of which, after preservation, measured 170 mm. in total length (1929, l.c.). Again, on the night of September 6, a captive Futsing Hsien specimen laid 5 eggs with very thin shells. These data agree well with those of Mell (1922, l.c.) who reports a Kwangtung female in which 7 eggs measuring 32-33 x 17-18 mm. were found August 6. The dimensions of these eggs indicate that they were well advanced, since two average ones found in two Fukien females measured only 20 x 10 and 22 x 12 mm., respectively.

Thirteen gravid females from Fukien contain 13, 11, 10, 9, 8, 8, 8, 7, 7, 6, 6, 4 and 4 well-developed eggs, respectively. The body length of the smallest gravid female is 420 mm.

Egg-teeth are present in four of five hatchlings from Chungan Hsien (American Museum Nos. 34423-27).

The female brought in at Kuatun with the clutch of 10 eggs described above was very docile and remained quietly coiled about her eggs for several days. Her quiet behavior was without doubt due to her proximity to the eggs, since *percarinata*, as stated below, is unusually excitable and shy. When handled she retained her composure without any show of defensive reaction.

This species is unusually active and has developed to a marked degree the habit of throwing and twisting its body about violently when held. It strikes and bites viciously when disturbed. (Pope, 1929, l.c.)

*Material examined*.—I have seen the following material: a large series from Fukien, 1 specimen from Yenchingkou, and 1 from an unknown locality, in the American Museum; the type from Kuatun, 2 examples from southern Fukien, a series from Ngoi-Tio, 1 specimen each from Thai-Nien and Kontum, and 1 from Formosa, in the British Museum; material from Pingsiang and Formosa, in the Naturhistorisches Museum, Vienna; 1 specimen from Tsingtao, in the Senckenbergisches Museum, Frankfurt; 1 from Kwanhsien, in the Berlin Museum; 1 from Ichang, 2 from Tunglu, and 1 from Ngoi-Tio, in the Museum

of Comparative Zoölogy; 1 each from Kuatun, Kuliang, Hwangtsaopa, and Lohsiang, 2 from Mt. Omei, 9 from Süchow, 2 from Yachow and region, and 6 from Chouchiakou, in the U. S. National Museum.

*Remarks*.—Mell (1929, p. 3, etc.) makes frequent reference to *percarinata*.

18. *Natrix piscator* (Schneider)

Figures 27 and 64, a

*Hydrus Piscator* Schneider, 1799, Hist. Amphib., I, p. 247 (type locality, East Indies).

*Amphiesma flavipunctatum* Hallowell, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 503 (type locality, Chukiang, Kwangtung).

*Tropidonotus quincunciatus* Boettger, 1885, Ber. Offenbach. Ver. Naturk., XXIV-XXV, p. 122 (Canton).

*Tropidonotus sancti-johannis* Boulenger, 1890, Fauna Brit. India, p. 350 (type locality, Kashmir).

*Tropidonotus chrysargus* Steindachner, 1914, Denkschr. Akad. Wiss. Wien (math.-natur.), XC, p. 359 (northern Formosa) (not of Schlegel, 1837).

*Natrix piscator* Chang and Fang, 1931, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VII, p. 259 (Nanking?; Wenchow, Chekiang; Amoy).

*Description*.—Upper labials 9, very rarely 8; preoculars single; postoculars 3, occasionally 4, very rarely 2 or 5; anterior temporals 2, very rarely 1 (3); posterior temporals 2, rarely 3; scales keeled, in 19 rows anteriorly, 17 posteriorly, occasionally reduced to 15 or 16 posteriorly; ventrals in sixty-seven males 122-133, in forty-three females 134-145; subcaudals in fifty-one

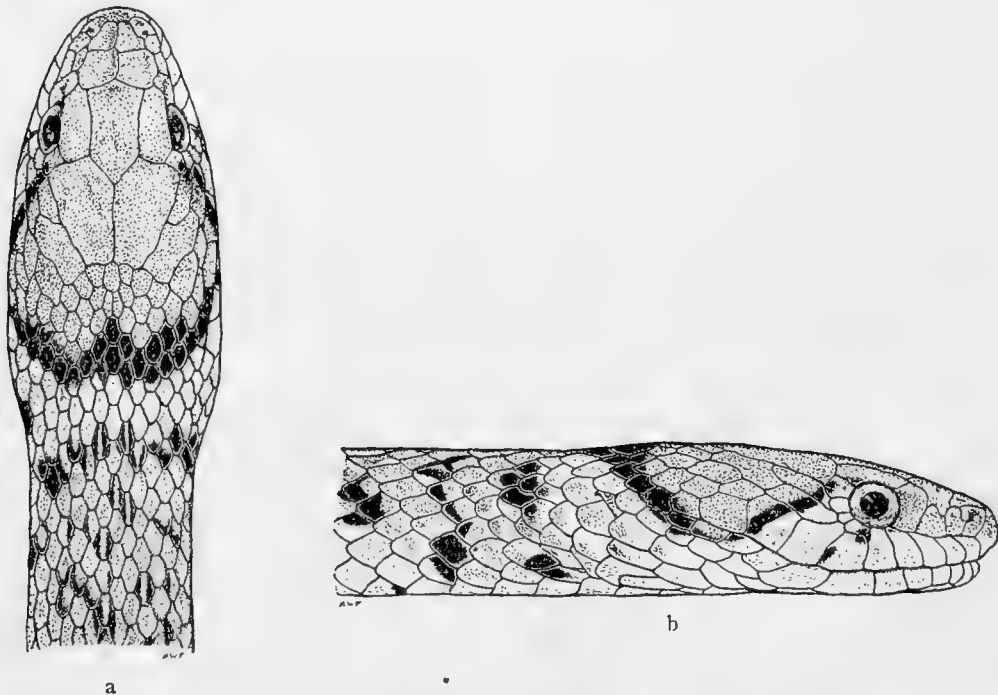


FIG. 27. *Natrix piscator*.  $\times 2$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 35079 from Hokow, Kiangsi.

males 73-88, in thirty-four females 64-77; greatest total length of female 975, of male 668 mm. Color, variable but usually grayish brown above, many scales with black margins arranged to form more or less distinct lines or, on the sides of the neck, vertical bars; ventrals whitish, each plate narrowly margined with black anteriorly; on the occiput, a narrow, black, crescentic band, often broken in the middle; head with a narrow, oblique, black line extending from the lower edge of the orbit to the labial margin, and another similar one paralleling the first but situated behind the eye. (Description based on one hundred and ten specimens from Hainan.)

This snake is so variable in coloration that Fan (1931, p. 57) has been able to distinguish six types of general dorsal color exhibited by a large Kwangsi series. Yunnan specimens may be quite uniform above, lacking all signs of the usual rather complex pattern (*sancti-johannis*).

The three largest males and females, respectively, among ninety Fukien and Kiangsi and three Yunnan specimens, taken together, measure 480, 431, 419 and 738, 680, 655 mm. In spite of the fact that only twenty-two of the series of ninety-three are males, these data, like those given in the standardized description above, prove beyond doubt that the females greatly exceed the males in size.

The ventral and subcaudal range of additional series are given in Table VII in which the numbers of specimens counted are indicated by figures in parentheses.

TABLE VII. VENTRAL AND SUBCAUDAL COUNTS OF *NATRIX PISCATOR* FROM CHINA

Locality	Sex	Ventrals	Subcaudals	Reference
Canton.....	♂ + ♀	(29)125-142	(19)71-86	Boettger, 1888, p. 77
Yaoshan.....	♂	(20)123-138	(15)62-82	Fan, 1931, p. 58
Yaoshan.....	♀	(23)135-145	(18)67-74	Fan, 1931, p. 58
Fukien and northeastern Kiangsi...	♂	(7)127-135	(7)78-83	Pope, 1929, p. 399
Fukien and northeastern Kiangsi...	♀	(9)138-146	(7)68-74	Pope, 1929, p. 399 (maximum ventral count corrected from 155 to 146)

Cope (1895, Pl. xxii, fig. 8) has figured the hemipenis which is largely spinous and shallowly forked. His illustration is reproduced here as Figure 64, a. Wall (1921, p. 95) has also described this organ.

*Distribution*.—*N. piscator* has been secured at the following localities in China:

Chekiang: Wenchow.

Kiangsi: Hokow.

Fukien: Chungan Hsien; Yenping; Foochow; Kuliang; mountains at mouth of Min River; Futsing Hsien; Amoy.

Kwangtung: Swatow and vicinity; Chonglok; Kowloon; Lilong; Fumun; Canton.

Hainan: Hoihow; Kachek; Tingan; Nodda.

Kwangsi: Yaoshan.

Yunnan: Yuankiang; Namting River.

Boulenger (1899, p. 163) lists *piscator* from Kuatun but I doubt that it actually occurs so high in the mountains of northwestern Fukien although it is present in valleys not far away from Kuatun. Chang and Fang (1931, p. 259) give a doubtful record for Nanking, while little credence can be given to Tchang's (1932, p. 9) Peiping one. I am not certain about the identity and location of Stanley's (1919, p. xv) Hwaiyuan.

Widely distributed in southern Asia and the Malay Archipelago.

*Habits and Habitat*.—I found this snake abundant everywhere in northern Fukien save in the forested Kuatun mountains. Mell (1922, p. 116) states that it is common in Kwangtung to an altitude of 300 meters but absent in mountain forests. In Fukien, *piscator* is semi-aquatic, frequenting wet and moist grassy banks and terraces and flooded fields. It does not hesitate to wander some distance from water, however.

I secured evidence of *piscator* eating fish (*Barbus*, etc.), and frogs (*Rana* and *Bufo*). The Hainan snakes seemed to prefer frogs, those from Fukien and Kiangsi fish (Schmidt, 1927, p. 434, and Pope, 1929, p. 399). Meggitt (1931, p. 413) has reported finding insect remains in this snake, but this is no proof that the species eats insects (compare remark under *N. chrysarga*).

Mell (1922, p. 116) reports five clutches of 11-15 eggs each in Kwangtung, while the two gravid Fukien females examined contain 20 and 42 ova (not 14 to 42 as wrongly stated by me, 1929, p. 399). On Java, eggs were laid from July 20 to August 9 and hatched in October. The clutches contained from 18 to 52 eggs each and the newly-hatched young measured from 170 to 181 mm. (Kopstein, 1930, p. 302, fig. 2.) The period of incubation on Java is about 87 days (Kopstein, 1932, p. 78, fig. 1). The record number of eggs for *piscator* to lay is 88 (Prater, 1927, p. 225).

Mell (1929) refers repeatedly to the behavior of *piscator*, while Smith (1921, p. 196) describes rescuing a *piscator* from the jaws of another snake, *Cylindrophis rufus*, so the latter may be numbered among the enemies of *piscator*.

Wall (1907, pp. 857-870, and 1921, pp. 91-102) has given excellent accounts of this species. A summary of his salient data follows:

1. It frequents the neighborhood of water but may wander some distance from it where vegetation is rank and damp enough to harbor frogs (p. 93).
2. It is exceedingly vicious and strikes repeatedly and with great rapidity, often holding on tenaciously (p. 93).
3. When cornered, it erects the fore-body and flattens the neck cobra-wise before striking (p. 93).
4. It is mainly diurnal but is often encountered at night (p. 93).
5. It is extremely active and agile, at times actually leaping clear of the ground when pursued; it is also an admirable swimmer (pp. 93-94).
6. It aestivates in the hotter parts of India, and hibernates in the cooler ones (p. 94).
7. Its food consists of frogs (including *Bufo*) and fish; it has, however, been known to eat a mouse (pp. 94-95).
8. *N. piscator* is oviparous, laying from 8 to 87 eggs which measure 27-40 x 18-25 mm. (pp. 96-97).
9. The hatchlings escape from the eggs by means of an egg-tooth, and measure from 170 to 215 mm. (p. 97).
10. Its breeding season is protracted, egg-bound females having been found in various parts of India from May to November, inclusive. In Assam, gravid females have been noted in December, January, February, April and May; egg clusters in May and August, and hatchlings in June and September. At Mandalay, a gravid female was secured in March, while females in this condition have been found at Rangoon in January and February (p. 96).
11. Judging by a Rangoon female that was found mating January 3 and deposited (in captivity) 14 of her clutch of 24 eggs on March 9, the period of gestation is about 65 [not "55"] days (pp. 95-96).

*Remarks:*—This species is so variable that it has already received many names and there is little doubt that a thorough study will result in the erection of good geographical subspecies based largely on color. The material from southeastern China is relatively constant in coloration, never exhibiting many of the patterns found elsewhere, and Hallowell's *flavipunctatum* is available for it. I prefer to let the matter rest until the various forms can be definitely defined and assigned to geographical areas. I consider *sancti-johannis* a color variety without a good geographical distribution. Although I studied the problem quite independently by examining a large amount of material in the British Museum and elsewhere, Wall apparently came to the same conclusion some time ago and placed *sancti-johannis* in the synonymy of *piscator* (1923, p. 603).

#### 19. *Natrix popei* Schmidt

Figure 28

*Tropidonotus chrysargus* Boulenger, 1899, Proc. Zool. Soc. London, p. 957 (part: Wuchih Mts., Hainan).

*Tropidonotus vibakari* Mell, 1922, Arch. Naturg., LXXXVIII, Abt. A, Heft 10, p. 115 (Linping, Kwangtung) (not of Boie, 1826).

*Natrix popei* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 3 (type locality, Nodda, Hainan); 1927, Bull.

Amer. Mus. Nat. Hist., LIV, p. 432, fig. 14 (amplified description of type; description of paratypes from type locality).

*Natrix vibakari popei* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 320 (Yaoshan, Kwangsi).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 64 (Lohsiang, Kwangsi).

*Description*.—Upper labials 8, 4th and 5th or 3rd, 4th and 5th entering orbit; preoculars single; postoculars 3; anterior temporals 1 or 2; posterior temporals 1 or 2; scales keeled, 19-17; ventrals 130-140; subcaudals 78-88; maximum total length 380 mm. (Description based on the five paratypes, and a Hainan specimen, the latter in the British Museum.)

Fan (1931, p. 66) describes a series of thirty-nine specimens from Lohsiang as follows: upper labials 8, postoculars 3, temporals 1+1, 1+2 or 2+1, ventrals 131-140, subcaudals 71-85, etc. The ventral and subcaudal counts of two males from Yaoshan (Mell, 1930, p. 320) and a female from Linping are 137, 137, 138 and 75, 79, 71, respectively.

Special note should be taken of the labial and nuchal patterns in comparing this snake with its allies, *vibakari*, *sauteri*, *craspedogaster*, etc.

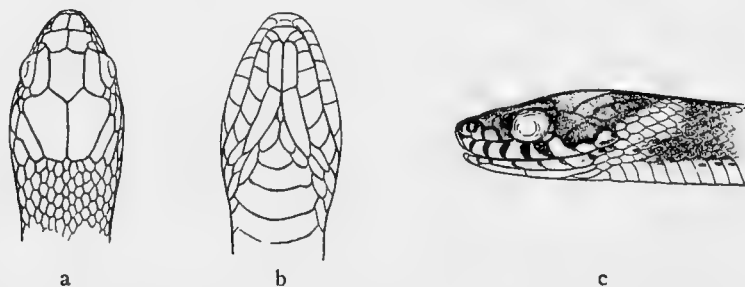


FIG. 28. *Natrix popei*. Type.  $\times 2$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head and neck.

Schmidt's amplified description of the type, a male, follows:

Size small, head moderately distinct from body, tail long. Maxillary teeth 20 [28], gradually enlarged posteriorly. Rostral vertical, only its edge visible from above, wider than high, its suture with the internasal about equal to that with the first labial; internasal suture about two-thirds as long as that of the prefrontals; nasal divided, nostril lateral; loreal nearly quadrangular, a little longer than high; one preocular and three postoculars; temporals 2-2 on each side, the upper anterior small; upper labials 8, the fourth and fifth entering the eye; lower labials 9, four in contact with the anterior chin-shields, which are shorter than the posterior; first pair of lower labials separated by the triangular mental. Dorsal scales distinctly keeled, the outermost row smooth, in 19-17 rows; apical pits absent on most scales, occasionally present, but small and faint; ventral plates 133, subcaudals 78; anal divided.

General dorsal color dark brownish gray, lightest in two dorsolateral bands, in which are situated, on each side, a row of white, vertical, dark-edged spots, extending to about mid-body, absent posteriorly; venter white, a row of black spots on each side, one on each ventral, larger posteriorly and confluent into black latero-ventral lines; ventrals outside of these spots clouded with the dorsal color; each side of the neck with a broad light mark, the two nearly



united dorsally; top of head, and lateral scales, with fine vermiculations or punctulations of white spots; a characteristic labial pattern of the *vibakari* type (compare Stejneger, 1907, fig. 240); first six labials white with black posterior edges; seventh white at the labial border, dark above, edged with black; eighth with a flask-shaped white spot which reaches the labial border at the anterior corner; lower labials with narrow black marks on their sutures; loreal light, with dark margins. Total length 356 mm.; tail 107 mm., ratio of tail length to total, .30.

The hemipenis is spinous and shallowly forked at the tip; a single very large, basal hook or spine is present, while conspicuous, longitudinal ridges, especially well developed proximally, are evident. The sulcus has prominent lips. (Description based on a Hainan specimen.)

*Distribution*.—This snake is known only from Yaoshan in eastern Kwangsi; Linping in northern Kwangtung; and Hainan.

*Habits and Habitat*.—*N. popei* is apparently an inhabitant of mountain and hill streams. Mell (1922, p. 115) secured his Kwangtung example between 600 and 800 meters above sea-level. My Hainan series was not taken at such high altitudes.

One of the paratypes (American Museum No. 27765) held two well-developed eggs with embryos still in very early stages of development. This indicates that *popei* is oviparous.

*Material examined*.—I have seen the following specimens: the type and paratypes, in the American Museum; 1 example from the Wuchih Mountains, Hainan, in the British Museum; 1 from Linping, in the Berlin Museum; 1 from Lohsiang, in the Museum of Comparative Zoölogy; and 1 from the same locality in the U. S. National Museum.

*Remarks*.—This snake together with *vibakari*, *sauteri*, *craspedogaster*, etc., form a close and difficult group in which the labial and nuchal patterns assume great importance due to astounding constancy within each species. This fact cannot be neglected. Lack of full appreciation of this point has, apparently, led Mell (1931, p. 204) and others to consider *popei* a form of *vibakari*.

## 20. *Natrix sauteri* (Boulenger)

Figure 29

*Tropidonotus sauteri* Boulenger, 1909, Ann. Mag. Nat. Hist., (8) IV, p. 495 (type locality, Kosempo, Formosa).

—Thompson, 1914, Proc. Zool. Soc. London, p. 385 (anatomy).

*Natrix copei* Van Denburgh, 1909, Proc. Calif. Acad. Sci., (4) III, p. 52 (type locality, Kanshirei, Formosa).

*Natrix* sp. cf. *sauteri* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 67 (Lohsiang, Kwangsi).

*Description*.—Table VIII includes the available data on all known Chinese specimens and a summary of most of the data for Formosan material tabulated by Maki.

TABLE VIII. LEPIDOSIS OF *NATRIX SAUTERI*

Locality	Sex	Number of Specimens	Upper Labials	Upper Labials Entering Eye	Lower Labials in Contact with Anterior Chin-shields	Precoculars	Postoculars	Anterior Temporals	Posterior Temporals	Scale Rows	Ventrals	Subcaudals	Museum or Reference
Lohsiang.....	♂	2	7	3-4	4	1	2-3	1	2-3	17-17-17	123-125	78-83	Fan, 1931, p. 68
Lohsiang.....	♀	3	7	3-4	4	1		1		17-17-17	120-127	72-76	Fan, 1931, p. 68
Linping.....	♂	2	7	3-4		1	3	1-2		17-17-17	127-133	(1)80	Berlin Museum Nos. 27668 and ?
Southern Fukien..		1	7					1			126	85	British Museum
Chouchiakou.....	♀	1	7	3-4			3	1		17-17-17	140	75	U. S. Nat. Mus. No. 84362
Formosa.....	♂	7	7			(6)1	(4)2-3	(4)1-2	(4)1-3	(4)17-17-17	123-131	(6)78-92	Maki, 1931, p. 31
Formosa.....	♀	7	7			1	(5)2-3	(5)1-2	(5)1-2	(5)17-17-17	120-135	(5)68-81	Maki, 1931, p. 31

Whenever, in Table VIII, the number of specimens comprising the basis of counts given does not equal that indicated in the second column, the correct number, enclosed in parentheses, is placed adjacent to the counts in question.

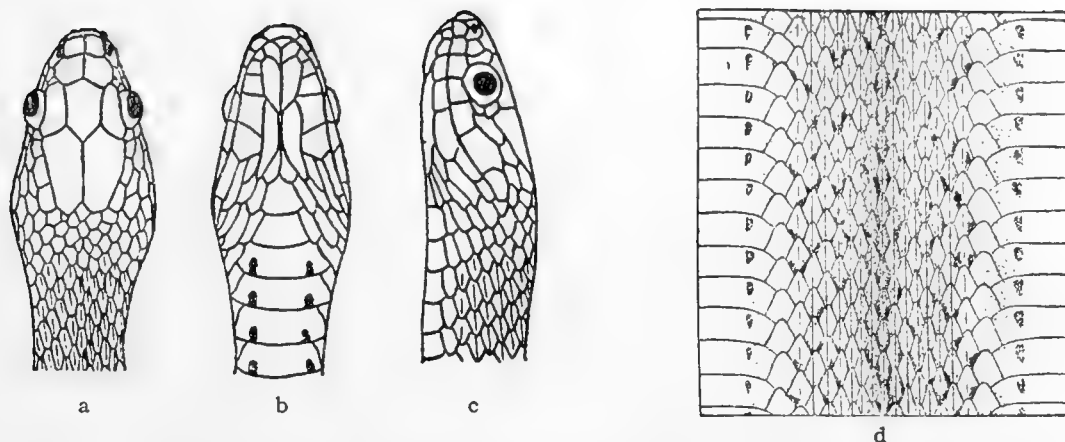


FIG. 29. *Natrix sauteri*. x 2. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. d. Pattern at midbody. Specimen from Formosa. (From Maki.)

The original description follows:

Maxillary teeth 23, posterior feebly enlarged. Head small. Eye moderate. Rostral broader than deep, just visible from above; internasals as long as broad, shorter than the præfrontals; frontal once and a half as long as broad, a little longer than its distance from the end of the snout, much shorter than the parietals; loreal as long as deep; one præ- and three postoculars; temporals 1 + 1 or 1 + 2; seven upper labials, third and fourth entering the eye; four lower labials in contact with the anterior chin-shields, which are much shorter than the posterior. Scales strongly keeled, of outer row smooth or feebly keeled, in 17 rows. Ventrals 125-130; anal divided; subcaudals 78. Dark grey-brown above, with small black spots, with a rather ill-defined reddish-brown streak on each side of the back, bearing, on the anterior part of the body, a series of distant small whitish spots; upper surface of head with black vermiculation; an oblique whitish streak across each side of the nape; upper lip spotted black and white; lower parts yellowish white, with a black spot near the outer end of each ventral, these spots forming a strongly marked ventro-lateral series. Two specimens, male (V. 125; C. 78) and female (V. 130; C. ?), from Kosempo.

*Distribution*.—*N. sauteri* is known only from Lohsiang in eastern Kwangsi; Linping in northern Kwangtung; southern Fukien; Chouchiakou in Szechwan; and Formosa.

*Habits and Habitat*.—The Szechwan example (U. S. Nat. Mus. No. 84362 was collected between 2000 and 4500 feet above sea-level, and Mell's Linping material was probably taken at 1800 or more feet. These data indicate that, in China, *sauteri* inhabits mountains.

Mell (1929, p. 138) gives evidence that it feeds on slugs and tadpoles.

U. S. Nat. Mus. No. 84362 held five well-developed eggs with very small embryos, so one may conclude that *sauteri* is oviparous.

*Material examined*.—I have seen 1 example from southern Fukien, in the British Museum; 2 from Linping, in the Berlin Museum; and 1 from Chou-

chiakou, in the U. S. National Museum (No. 84362). I have also examined good series from Formosa.

*Remarks:*—Thompson (1914, p. 385) has given notes on the anatomy of this species.

#### 21. *Natrix stolata* (Linnæus)

*Coluber stolatus* Linnæus, 1758, Syst. Nat., Ed. 10, p. 219 (type locality, "America"); 1766, Ed. 12, I, p. 379 (Asia).

*Amphiesma stolatum* Duméril and Bibron, 1854, Erp. Gén., VII, p. 727 (China).

*Natrix stolata* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 397 (Futsing Hsien, Yenping and Chungan Hsien, all in Fukien).

*Natrix stolata chinensis* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 319 (type locality, Yaoshan, Kwangsi); 1931, Lingnan Sci. Journ., VIII, p. 201.—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 58 (Lohsiang, Kwangsi).

*Description:*—Upper labials 8, very rarely 7; preoculars single, very rarely divided; postoculars 3, very rarely 2 or 4; anterior temporals 1, very rarely 2; posterior temporals 2, occasionally 1; scales 19-17, keeled; ventrals in fifty-five males 143-156, in fifty-two females 148-158; subcaudals in thirty-eight males 69-87, in twenty-eight females 70-86. Color variable, but usually the snake is light gray with weak dark bands across the middorsum; each of these terminates in a light spot on neck and anterior part of body but these spots merge into one another about midbody to form a conspicuous, light lateral stripe which continues unbroken to end of tail; belly white, save for the yellow throat. (Description based on one hundred and seven specimens from Hainan.)

The maximum total length in thirty-eight Hainan males is 634 mm., in twenty-eight Hainan females 687 mm. (Schmidt, 1927, p. 435), while the three largest males and females among seventy-four from Fukien and northeastern Kiangsi measure, respectively, from snout to vent, 420, 413, 410 and 499, 485, 478 mm. (Pope, 1929, p. 397). Wall (1921, p. 120) gives the maximum total length for Indian material as 567 mm. in the male, 735 mm. in the female. The tail in *stolata* occupies almost exactly a quarter of the total length. The female is thus seen to exceed the male in size but there is almost no sexual difference in ventral and relatively little in subcaudal counts.

The ventral and subcaudal counts of *stolata* from various parts of China show only a small range of variation (Boettger, 1888, p. 80; Fan, 1931, p. 60; Pope, 1929, l.c.; etc.).

The hemipenis of a Hainan specimen has already been illustrated by Cope (1895, Pl. XXIII, fig. 6). While this figure shows the generally spinous nature of the hemipenis, it does not indicate that the organ is shallowly forked at the tip. I have compared Cope's plate with another Hainan example which is forked opposite the tenth and eleventh subcaudal plates.

*Distribution:*—In the coastal provinces of southeastern China, *stolata* is

widely distributed, there being numerous records for Kwangtung including, in the north, the mountains along its northern boundary, and, in the south, the Island of Hainan. Farther north, *stolata* ranges to Tunglu and the Chusan Islands in Chekiang and Hokow in northeastern Kiangsi. It is reported from Lohsiang, in eastern Kwangsi, and Monghum in western Yunnan, but these are the only definite records that I can find for regions west of Kwangtung, Kiangsi, Fukien and Chekiang. Thus it appears to avoid the Yunnan plateau. Wall's (1925, p. 810, and 1926, p. 561) records for the Kachin Hills and the North Shan States show that *stolata* is by no means rare in that part of Upper Burma lying adjacent to Yunnan.

Distributed over India (including Assam) and the peninsula of southeastern Asia. *N. stolata* is recorded from Ceylon and Formosa. Its presence in the Malay Archipelago is doubtful (de Rooij, 1917, p. 88, and Taylor, 1922, p. 86).

*Habits and Habitat*.—Mell (1922, p. 116) reports this as the commonest snake in the Canton region and he even met it at 1000 meters altitude on Lofaoshan. I found it extremely abundant in the open, rolling country about Nodoo. In Fukien, it was common in the high valleys near Yenping, less so on the Chungan plateau, and lacking in the mountains about Kuatun and Sanchiang. Its presence on the Kiangsi side of the Fukien-Kiangsi divide is evidenced by specimens collected at Hokow. Annandale (1911, p. 218) took his western Yunnan (Monghum) specimen at about 5000 feet above sea-level.

I found little evidence of a direct association between *stolata* and water, so I would not describe it as aquatic to any degree. It does, however, prefer areas that are relatively moist but this may be due to its subsisting on frogs (Schmidt, 1927, l.c., and Pope, 1929, p. 398). Above Yenping, I generally met *stolata* along roads running between open valleys below and wooded hills above. When startled, it made a sudden, noisy dash for safety in a rather un-snake-like manner. Further proof of this snake's preference for an amphibian diet is found in six specimens from Hainan, four of which contain remains of unidentifiable frogs, while two hold frogs of the genus *Microhyla*. Schmidt's (1927, l.c.) report on this series did not include these data.

In disposition, this is the most gentle of snakes, and I never saw one either strike or bite except very ineffectively. When alarmed the head is raised.

Table IX, based almost entirely on dissection of gravid females in the American Museum, gives a general idea of the fecundity of *stolata* in China as well as its breeding season there.

Table IX well illustrates the usual correlation between size of female parent and number of offspring.

Re-examination of a part of Schmidt's (1927, l.c.) Hainan series shows that

TABLE IX. DATA ON BREEDING OF *NATRIX STOLATA* IN CHINA

<i>Length of Female from Snout to Vent in Millimeters</i>	<i>Number of Eggs</i>	<i>Size of One Egg in Millimeters</i>	<i>Date</i>	<i>Locality</i>	<i>Amer. Mus. No.</i>
356	5	22 x 8	Aug. 24-Oct. 5	Futsing Hsien	33976
418	6	22 x 9	Aug. 24-Oct. 5	Futsing Hsien	33973
428	8		April 12-Aug. 6	Yenping	33478
478	10		April 12-Aug. 6	Yenping	33476
461	12		April 12-Aug. 6	Yenping	33473
499	9		June 16	Chungan Hsien	33752
492	14		June 28-July 12	Hokow	35078 (wrongly recorded as <i>piscator</i> by me, 1929, p. 398)
	4	15 x 11	June 8	Nodoa	(field observation)

two females contain 5, two 6, four 7, and one 10 eggs in advanced stages of development.

*Natrix stolata* has been treated exhaustively by Wall (1911, pp. 603-626, and 1921, pp. 105-126). His accounts confirm, in general, the meager one given above and a few additional points of special interest have been abstracted from his later one to be included here, as follows:

1. Some specimens, when irritated, depress the neck and much of the body, and assume an erect position, somewhat as cobras do, but to a much lesser degree (p. 109).
2. *N. stolata* is essentially diurnal (p. 109).
3. It aestivates during the dry season in parts of India, while in northern India it hibernates (pp. 109 and 110).
4. Its diet consists of the commonest frogs or toads of the region in which it lives, but it has been known to eat a gecko. A captive *stolata* ate 131 toads in a year, while another consumed 91 green frogs (pp. 111 and 112).
5. Three snakes may be included among its enemies: *Xenopeltis unicolor*, *Ahætulla mycterizans* and *Bungarus fasciatus* (p. 112).
6. The mating season coincides with the dry season, the sexes, apparently, retiring into aestivation in pairs (p. 113).
7. On continental India, gravid females have been commonly reported from April to August, inclusive, rarely in October (p. 114).
8. Females have been known to deposit eggs in July, August and September, but eggs have been unearthed as early as May (pp. 114-119).
9. The period of gestation is probably about two months, that of incubation some 50 days (pp. 115, 116 and 118).

10. Hatching has been reported at Rangoon August 1 and 3 and October 22, in Assam on June 10 and July 5 and 6 (pp. 117 and 119).

11. The female may remain with her deposited eggs, possibly even until hatching (pp. 115 and 116).

12. The eggs measure 22-35 x 16-18 mm. and number 1-14 to a clutch (p. 117).

13. Hatchlings measure from 133 to 178 mm. (p. 119).

14. The young escape from the eggs by means of an egg-tooth (p. 118).

*Material examined*.—I have seen the following specimens from China: 107 from Hainan, 81 from Fukien, 3 from Kiangsi and 1 from an unknown locality, in the American Museum; 2 from Chusan, 1 from Hainan and 1 from "China," in the British Museum; 1 from Tunglu and 1 from Hainan, in the Museum of Comparative Zoölogy; 1 each from Canton, Kuliang and Foochow, in the U. S. National Museum.

22. *Natrix subminiata subminiata* (Schlegel)

*Tropidonotus subminiatus* Schlegel, 1837, Phys. Serp., II, p. 313 (type locality, Java).

*Natrix subminiata* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 436 (Nodoa, Hainan).

*Natrix subminiata hongkongensis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 203.

*Natrix subminiata siamensis* Mell, 1931, l.c.

*Description*.—Upper labials 8, 3rd, 4th and 5th entering orbit; preoculars 1 or 2; postoculars 3; anterior temporals 2; posterior temporals 2, 3 or 4; scale formula 17-19-17, 19-17, 19-17-19-17 or 18-19-16; ventrals in the single male 149, females 150-155; subcaudals in the females 69-73; largest specimen 810 mm. total length. (Description based on four *Nodoa* specimens.)

In general appearance, these Hainan *subminiata* strongly resemble *helleri* from the Chinese mainland.

The hemipenis of a specimen from Hainan agrees generally with that of the Yenping *helleri* described below but differs in extending to the twelfth subcaudal plate and being forked opposite the sixth. These slight differences might well be individual rather than subspecific.

*Distribution*.—The Hainan material apparently forms the only Chinese record of this subspecies. It is elsewhere widely distributed over the lowlands of the southern part of the peninsula of southeastern Asia and is well known in the Malay Archipelago.

*Habits and Habitat*.—Its presence at *Nodoa*, Hainan, proves that the typical form occurs at low altitudes in the latitude of Hainan.

A frog of the genus *Microhyla* was found in the stomach of American Museum No. 27759 from Hainan.

Kopstein (1930, p. 301) records a Javanese female laying 8 eggs on May 14. The eggs measured 24 x 14 mm. He also found newly-hatched young on January 27, July 16 and 25 and September 29. American Museum No. 27761

from Hainan holds 15 advanced eggs the average dimensions of which are 20 x 11 mm.

Wall (1925, p. 810) states that two captive Burmese *subminiata* "erected themselves and flattened the fore body making a great demonstration of anger but refused to bite on provocation."

*Material examined*.—I have seen 4 Hainan specimens in the American Museum.

*Remarks*.—The Hainan snakes being intermediate between Javanese and mainland Chinese material, it is impossible to say just what their status really is. I do not like to assign a name to a form until a logical range can be worked out for it and this is why I am not using Mell's name *siamensis*. This question cannot be settled until a careful study of good series from Indo-China, Siam and Burma has been made. In studying *subminiata* from various parts of its range, habits, size, duration of juvenile pattern and tail length should be taken into consideration. The form *helleri* is apparently much larger than Javanese *subminiata* (Barbour, 1912, p. 112).

Mell's form, *hongkongensis*, is apparently based on Boulenger's (1893, p. 256) counts of a small Hongkong series credited to J. C. Bowring, but since I found several other typically Javanese species secured through Bowring listed from Hongkong by Boulenger, I prefer to throw the material in question out of the Chinese fauna. It is well known that much of Bowring's collection actually came from Java, for I have seen his catalogue in the British Museum. This last question will be promptly settled when the first new lot of *subminiata* is received from Hongkong.

### 23. *Natrix subminiata helleri* Schmidt

Figure 30

*Tropidonotus subminiatus* Anderson, 1879, Zool. Res. W. Yunnan, p. 822 (stated to be "not uncommon" in the valleys of Chanta, Nantien, Tengyueh and Husa, western Yunnan) (not of Schlegel, 1837).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 117 (Tinghushan, 200-700 meters; Lofaoshan, 200-700 meters; Lokchong, 150 meters; Chiufeng, 500 meters; Shuiyuanshan; Lungtou, 400-800 meters; all six localities in Kwangtung) (not of Schlegel, 1837).

*Natrix helleri* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 3 (type locality, Tengyueh, Yunnan, 5500 feet); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 515, fig. 11 (amplified description of type; paratypes from Yungchang and the Wuting District in Yunnan, Yenping in Fukien, and the type locality also described).

*Natrix subminiata helleri* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 60 (Lohsiang, Kwangsi).—Mell, 1931, Lingnan Sci. Journ., VIII, p. 203.

*Description*.—Fan's series of fourteen specimens from Lohsiang have 8, very rarely 9 upper labials; 1 preocular; 3, occasionally 4 postoculars; 2 anterior and 2 posterior temporals; and ventrals in six males 168-178, in six females 162-180; subcaudals in five males 80-92, in six females 78-85.



Table X shows that this snake from mainland China is constant in ventral counts.

TABLE X. VENTRAL AND SUBCAUDAL COUNTS OF *NATRIX SUBMINIATA HELLERI* FROM CHINA

Province	Number of Specimens	Ventrals	Subcaudals	Material or Reference
Yunnan.....	15	160-174	73-92	
Kwangsi.....	12	162-180	78-92	Fan, 1931, p. 61
Fukien.....	2	172-175	83	British Museum specimen and paratype in American Museum
Kweichow.....	1	175	83+	U. S. Nat. Mus. No. 68871

Mell (1922, p. 117) has good series from Kwangtung among which the ventrals and subcaudals never fall below 166 and 67, respectively (Mell, 1931, p. 203).

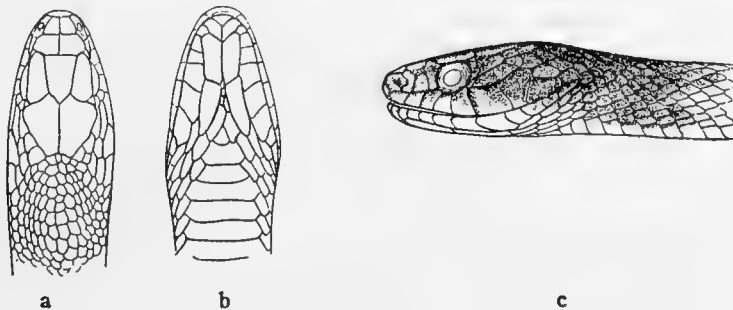


FIG. 30. *Natrix subminiata helleri*. Type. Nat. size. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head and neck.

Schmidt's amplified description of the type, a female, and his data on the paratypes, follow:

Habitus of *Natrix subminiata*. Nineteen subequal maxillary teeth, followed by two strongly enlarged ones. Rostral visible from above; internasals as long as broad, their sutures with the rostral subequal to those of rostral and first labial; internasals slightly shorter than the prefrontals; frontal slightly longer than its distance from the rostral, slightly shorter than the parietal suture; parietals truncate behind; frontal wider than the supraoculars; nasal divided; loreal higher than long; eight upper labials, sixth largest, seventh highest, and the third, fourth, and fifth entering the eye; ten lower labials; a single preocular; postoculars 2-3; temporals 2-2. Dorsal scales in nineteen rows at mid-body, twenty-two on the neck, and seventeen near the tail, narrow, strongly keeled, and notched at the tip; outer scale row smooth; a pair of faint scale pits, often difficult to discern; ventrals 169; tail incomplete.

General color uniform olive, with reddish markings on the neck, chiefly confined to the

skin between the scales; lower labials cream; upper labials gray anteriorly and posteriorly, the middle ones lighter, with a black mark on the 5th-6th suture.

The five paratypes agree in general with the type; No. 21047, ♀, from the type locality, has 21-19-17 dorsal scales; 165 ventrals; 83 subcaudals; labials 7-8; oculars 1-3; and temporals 2-3. This specimen measures 860 mm., the tail occupying .23 of the total. No. 21048 is from Yungchang, Yunnan; it agrees with the type in having an even number of scale rows on the neck, (twenty); ventrals 172; tail incomplete; labials 8-9; otherwise in complete agreement with the type. A specimen from Yenping, Fukien, A. M. N. H. No. 23533, ♂, collected November 25, 1921, by H. R. Caldwell, agrees excellently with the Tengyueh specimens. It has 172 ventrals, 83 caudals, upper labials 8, lower labials 10, oculars 1-3, and temporals 2-2 and 2-3. The characteristic coloration of the upper labials is present.

Unfortunately the left maxillary of the type on which Schmidt evidently made his count of 21 teeth is missing. The remaining right one holds 24 teeth.

The hemipenis extends to the twelfth to thirteenth subcaudal plates and is forked opposite the fifth. It has no enlarged basal spine or hook and is spinous throughout. The spines are nearly uniform in size but slightly smaller near the tip of the organ and arise from between smooth, continuous, longitudinal ridges. The sulcus is conspicuous, its lips but little raised and devoid of spines save on the extreme outer edge. (Description based on a specimen from Yenping.)

*Distribution*.:—This subspecies has been definitely secured or recorded from the following localities in China:

Fukien: Yenping.

Kwangsi: Lohsiang.

Kweichow: Hwangtsaopa.

Yunnan: Yunnanfu; Wutingchow region; Yungchang; the Tengyueh, Chanta, Nantien and Husa valleys.

Kwangtung: Tinghushan; Lofaoshan; Lungtou; Shuiyuanshan; Lokchong; Chiufeng.

I have seen specimens from Tongking and Upper Burma.

*Habits and Habitat*.:—*N. subminiata helleri* appears to be the northern highland representative of *subminiata*, and is found at high altitudes only. It presumably prefers mountain forests. Wall (1925, p. 810) states that *subminiata* is common in Burma to an altitude of 6500 feet, while the following altitudes of localities in Yunnan and Kweichow whence *helleri* has been recorded give a good idea of its habitat there: Yunnanfu 6400 ft., Yungchang 5500 ft., Wutingchow 6000 ft., Tengyueh 5365 ft., Chanta 2900 ft., Husa 4500 ft. and Hwangtsaopa 4320 ft.

Mell (1922, l.c.) gives July 22 and August 7 and 12 as hatching dates in Kwangtung. Wall (1926, p. 561) also gives interesting notes on the growth of *subminiata* in Burma and states that one example had devoured a toad, each of two others a frog. A Wuting Hsien *helleri* had eaten a frog (*Rana*).

*Material examined*.—I have seen the following specimens from China: 1 from Yunnanfu, in the Naturhistorisches Museum, Vienna; 1 each from Fukien and Wuting, in the British Museum; 1 each from Lohsiang and Yunnanfu, in the Museum of Comparative Zoölogy; 1 from Hwangtsaopa, U. S. National Museum No. 68871; and the type from Tengyueh, 2 paratypes from Wuting District, and 1 each from Yungchang and Yenping and a specimen from Wuting, in the American Museum.

*Remarks*.—This form, probably widely distributed over the higher regions of Tongking, Upper Burma and southern China, presents a most interesting problem. As stated above, it has from 160 to 180 ventrals, 67-92 subcaudals on mainland southern China, while the typical form from Java, the type locality, never exceeds 137 ventrals and 74 subcaudals (Barbour, 1912, p. 111, data on sixty-eight Javan examples given). The question as to what counts prevail in the territory between Java and China does not enter into the scope of this work, nevertheless a brief consideration of it will be found under *N. subminiata subminiata*.

#### 24. *Natrix tigrina lateralis* (Berthold)

Figure 31

*Tropidonotus tigrinus* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 71 (part: Ningpo).—Vogt, 1924, Zool. Anz., LX, p. 339 (part: Peiping region).

*Tropidonotus lateralis* Berthold, 1859, Nachrichten Ges. Wiss. Goettingen, p. 180 (type locality, China).

*Tropidonotus orientalis* Guenther, 1862, Proc. Zool. Soc. London, 1861, p. 391 (type locality, Peiping).

*Amphiesma tigrinum* David, 1872, Nouv. Arch. Mus. Hist. Nat. Paris, VIII, Bull., p. 51 (northern Kiangsi).—Mocquard, 1910, Bull. Mus. Hist. Nat., Paris, XVI, p. 150 (Lanchow, Kansu; Sian, Shensi).

*Natrix tigrina lateralis* Stejneger, 1907, Herp. Japan, p. 278.

*Description*.—Upper labials 7, very rarely 8; preoculars 2; postoculars 3, occasionally 4; anterior temporals single; posterior temporals 2, very rarely 3; scales keeled, in 19 rows on the neck and at midbody, 17, very rarely 15, before the vent; ventrals in fourteen males 148-160, in nine females 153-162; subcaudals in fourteen males 57-73, in seven females 52-65; the three largest males measure from snout to vent 730, 630 and 609, the three largest females 780, 730 and 730 mm. (Description based on nine specimens from Chungan Hsien, eight from the Western Hills and six from Tsinan.)

Sowerby (1930, p. 13) describes this snake from life as follows:

When in its new coat it is a most beautiful snake, being of a fine sap-green above, white on the under surface of the head, throat, and neck, dusky-green posteriorly. Narrow black bands occur on the upper lips, and increase in size and width as they extend all down the sides of the body, gradually fading and becoming obsolete on the tail. The spaces between these black bands are occupied with brilliant vermilion, very intense and extensive anteriorly, but gradually giving way to the general green of the upper parts towards the tail, disappearing altogether on the latter.

In adult males, the keels of the scales of the anal region are noticeably enlarged but could scarcely be described as knobbed.

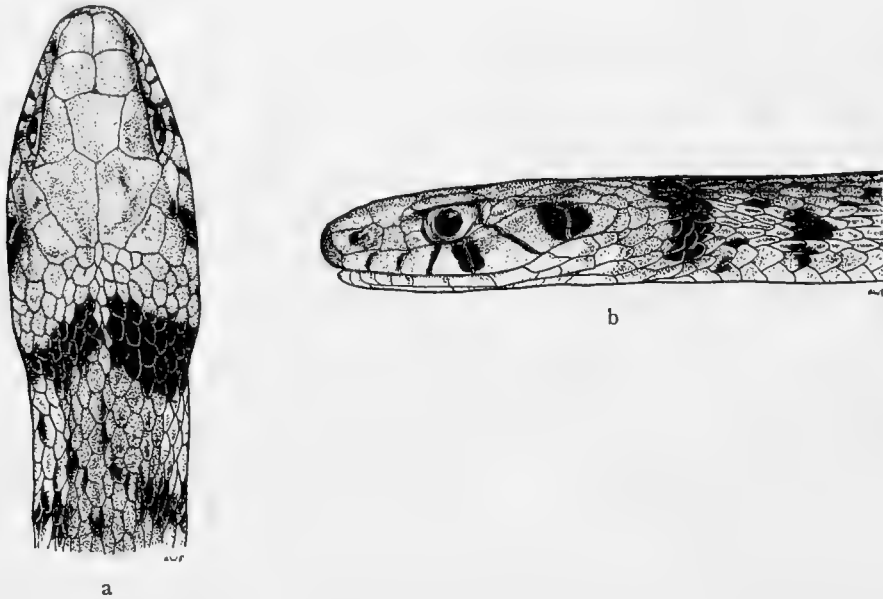


FIG. 31. *Natrix tigrina lateralis*.  $\times 1\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 28328 from Chintzu, Shansi.

A translation of the original description follows:

A *T.[ropidonotus]* with flat head, short snout, tail stout at the base; olivaceous above, with square black spots in rows on each side; below blackish green with a black spot on the lateral end of each of the scutes; scales sharply keeled, disposed in 19 series; ventrals 157, anals 2, subcaudals 56; tail  $\frac{1}{6}$  [of the total length].

The hemipenis is spinous and extends to the ninth subcaudal plate. It is forked opposite the fifth and has a single, enlarged basal spine or hook with a very thick base but a slender, curved point. The numerous spines, arising from between smooth, more or less reticulated or longitudinal ridges, are slender, curved and uniform save for a group of a few slightly enlarged ones situated distal to and on the opposite side of the sulcus from the basal hook. There is a gradual reduction in the size of the spines toward the tip of the organ where the fleshy ridges are more obviously reticulated. The sulcus is conspicuous but does not extend to the extremity of the hemipenis. Its lips are spinous, the embedded parts of the spines showing through the sulcus walls distal to the point of forking. (Description based on a specimen from the Western Hills.)

Cope (1895, Pl. xxii, fig. 7) figured the hemipenis of *N. tigrina tigrina*.

*Distribution*.—The range of *lateralis* extends from central China north-eastward through southern Manchuria to Olga Bay at about  $44^{\circ}$  N. Latitude

on the eastern Asiatic coast (Emelianov, 1929, p. 20); northward into Suiyuan; and northwestward into Kansu. The following selected locality records will serve to outline more definitely the known Chinese distribution of this form:

Chekiang: Ningpo; Talanshan; Chayuan.

Fukien: Kuatun.

Kiangsi: Lushan.

Hupei: Hankow.

Kweichow: Hwangtsaopa.

Szechwan-Yunnan border region south of Sūchow.

Szechwan: Wanhsien; Hochuan region; Sūchow; Yenchinghsi of Opie Hsien; Mt. Omei;

Yachow region; Kwanhsien.

Kansu: Hweihsien; Lanchow; Hoshui.

Shensi: Tsinling Mountains; Sian; 50 miles east of Yen-an; Yulin.

Suiyuan: Ordos; Maitaichao.

Mell (1929, p. 201) states that *lateralis* occurs in the "northern frontier mountains of Fukien and Kwangtung," but on what authority I do not know unless it is Stanley's 1916 (p. xiii) Changning record which, after all, is only a listing and might easily be based on a misidentification. I prefer to await confirmation of the occurrence of *lateralis* so far south.

In spite of certain more or less dependable records (Nikolsky, 1905, p. 222, and Wall, 1903, p. 86), it is safe to assert that *lateralis* does not occur on Hongkong Island, and Stejneger (1907, p. 318) long ago disposed of Boulenger's (1893, p. 250) Hoihow record. I believe that Stanley's (1916, p. xiv) listing of "*tigrinus*" from the Pagoda Anchorage, near Foochow, must be an error of some sort, and my attempts to identify Zarevskij's 1915 (p. 52) "Hankow" have been unsuccessful. It is probably in Hopei.

A large series of *Pseudoxenodon macrops* from Szechwan and Yunnan, in the Berlin Museum, has been erroneously identified as *Tropidonotus tigrinus* by Vogt (1924, p. 339, and 1927, p. 283).

*Habits and Habitat*.—This form is generally conceded to be aquatic but actually it varies considerably with latitude in its habitat preference. In the arid, dry, northern provinces of China it is prone to frequent the immediate vicinity of running water, but south of the Yangtze River, at Ningkwo, I constantly met it on grassy hillsides many hundreds of yards from water of any kind. In general, *lateralis* prefers clear, grass-grown streams or fields flooded with relatively clear water such as those found at Chintzu in Shansi. At Ningkwo it was met with only in the more elevated country bordering the level river valley and did not enter the low rice fields along the river itself.

A study of the localities at which *lateralis* has been taken forces one to conclude that in general it shows very little preference for any particular altitude but occurs wherever sufficient elevation affords a suitable habitat.

However, it is probably confined to mountains of considerable altitude along the extreme southern limit of its distribution, as for example, in the mountains dividing Fukien and Kiangsi and the high country lying between Yunnan and Szechwan, south of Sūchow. A specimen in the U. S. National Museum was taken at 6000 feet in the latter region.

Examination of *lateralis* stomachs in the American Museum gives the following results:

- 1 specimen contained remains of *Rana nigromaculata*.
- 2 specimens contained remains of *Rana limnocharis*.
- 1 specimen contained remains of two advanced tadpoles (*Rana*).
- 1 specimen contained remains of *Bufo raddei*.
- 4 specimens contained remains of unidentified frogs.

Food records already given by Schmidt (1927, p. 511) and by me (1929, p. 401) have been incorporated above. A young specimen that I confined at Chintzu greedily ate small frogs (*Rana*). Emelianov (1929, pp. 20 and 21) found that captive *lateralis* prefers Ranas but will also eat Bufos. Sowerby (1926, p. 231) states that, in addition to frogs, small fish, birds, chipmunks, rats and mice, and even grasshoppers are included in the diet of this snake but gives no data to substantiate this varied assortment of victims. In 1930 (p. 13) he mentions only frogs.

Two Chungan Hsien specimens collected by me (1929, l.c.) contain 9 and 5 eggs, respectively, one of the 5 measuring 32 x 12 mm. In addition, a Chintzu female, in the American Museum, collected between July 8 and August 14, holds 13 eggs, one of which is 22 x 11 mm. in diameter and contains an embryo too small to be disclosed by gross examination. At this last-named locality, a 240 mm. juvenile was secured on July 29, and, when measured again on August 29, had increased 50 mm. in length. During the intervening thirty-one days it fed voraciously on young frogs.

Emelianov (1929, p. 21) gives the dates for laying and hatching of captive females in the Far Eastern District as July 15 to 18 and September 1 to 3, respectively, the number of eggs in a clutch as 20-22, their dimensions as 40 x 15 mm., and the length of the hatchlings as 150-170 mm. In writing about Japanese *tigrina tigrina*, Maki (1931, p. 43) remarks that "they lay about 14 eggs in August or September" and adds that an egg measures about 36 x 20 mm.

When annoyed, *N. t. lateralis* does not actually bite but behaves in a very characteristic manner long ago described by Kreyenberg (1907, p. 209). The actions of a specimen observed by me at Chintzu may be described as follows (Schmidt, 1927, p. 512):

It flattened the whole body, especially the neck, and the sides of the neck were drawn down until the angle below was a right angle, or less, and the skin above was tightly stretched over the vertebræ. Just behind the head the neck was strongly arched, to such a degree as

to make a fold of loose skin appear under the head where head and neck meet. The head, held in this position, was raised from one to four inches from the ground. The body was thrown into varying but gracefully regular coils. This snake could not be induced to bite or strike, but when its body was pinched at any point it would turn and "butt" with its nose, but not with any particular violence. Sometimes the head and arched neck would be thrown well back, and then its attitude was much like that of a cobra. This flattening of the neck brings into vivid contrast the alternate red and green bars of its sides, and gives the snake a highly venomous appearance.

*Material examined*.—I have seen, among others, specimens from the following localities: Chayuan, Tunglu, Fenshui and Fuyang, four Chekiang localities, in the Museum of Comparative Zoölogy; 1 example from Hwangtsaopa, Kweichow, and 1 from the Szechwan-Yunnan border region south of Sūchow, in the U. S. National Museum.

*Remarks*.—Sowerby (1926, l.c.) has given a good general account of *lateralis*, but three of his statements require comment:

1. It would be very gratifying to have definite proof that as many kinds of animals as those named actually fall victim to *lateralis*.

2. Sowerby believes that *lateralis* does not occur below 2000 feet in northern China, but its presence at Peiping (Boring, Liu and Chou, 1932, p. 59, and Tchang, 1932, p. 6) certainly refutes this belief.

3. I can find no evidence that this snake "attains a length of 5 ft. and more." The largest individual among sixty-four in the American Museum is from Maitaichao and measures 998 mm. in total length, while the maximum length listed by Emelianov (1929, p. 22) is 1090, that by Maki (1931, p. 47) 991, and by Chang (1932, l.c.) 1031 mm. In short, among one hundred and eighteen measured individuals none exceeds 43 inches in total length. It would be much safer to give the length as three feet with three and a half as the maximum. It is interesting to note that Maki (1931, p. 43) states 1055 mm. to be the length of the largest *tigrina tigrina* in the Kyoto Museum.

#### Genus *Pseudoxenodon* Boulenger

*Pseudoxenodon* Boulenger, 1890, Fauna Brit. India, p. 340 (type, *P. macrops*).

All the valid forms of this genus except *stejnegeri* of Formosa, *jacobsoni* of Sumatra, and *inornatus* of Java, are included in the present work, so certainly southeastern China is the center of distribution, if not the point of origin, of the genus.

Although the relationship of *Pseudoxenodon* is obviously with *Natrix*, species of the former are distinguished from those of the latter not only by oblique scales but a characteristic type of hemipenis, specialization of feeding habits and defensive behavior as well. It must, nevertheless, be admitted that a more complete comparison of the two genera will tend to eliminate these differences and prove that a sharp line of demarcation cannot be drawn. *P. fruhstorferi* Werner, from Siam, is considered by Dr. Smith to be a synonym of *N. nigrocincta* (an opinion with which Werner, 1929, p. 29, concurs), and even

though no objection to this can be raised, examination of the type of *fruhstorferi* shows that Werner had some reasons for placing it in *Pseudoxenodon* which its somewhat oblique scales strongly suggest. It should not be forgotten that specimens of *P. macrops* from Yunnan have been more than once within the last twelve years identified as a species of *Natrix*. These facts serve to illustrate the difficulty of sharply separating *Pseudoxenodon* and *Natrix* and suggest that further comparisons are needed.

The halves of the bifurcate *Pseudoxenodon* hemipenis are of unequal length, apparently a condition resulting from the complex distal structure of the organ.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Scales keeled, oblique anteriorly, in 17 or 19 rows at midbody, 15 before the vent; last two maxillary teeth greatly enlarged.

A word of warning in regard to the number of scale rows at midbody is necessary for this genus because a reduction often takes place about midway between head and vent and therefore two midbody counts might easily be secured for the same specimen by different counters.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Light brownish gray above, body and tail crossed by 15 to 24 conspicuous, black or black and gray bands, the first of which sends a narrow black stripe forward along the neck to the parietals where it joins its fellow of the opposite side. . . . . *bambusicola*, p. 140
- II. No conspicuous black cross-bands above; no black stripe extending along the neck to join its fellow on the parietals
  - A. A narrow, middorsal, grayish stripe bordered with black present on the tail and persisting a variable distance anterior to the vent. . . . . *striaticaudatus*, p. 156  
*dorsalis*, p. 143
  - B. No black-bordered, grayish stripe present on tail
    1. Snout crossed immediately anterior to the eyes by a black band. . . . . *fukienensis*, p. 145
    2. Snout not crossed by a black band
      - a. Maxillary teeth 19-22; pattern more or less infused with yellow; a black nuchal spot pointed anteriorly, forked posteriorly, usually evident throughout life. . . . . *macrops*, p. 151
      - b. Maxillary teeth 26-27; pattern devoid of yellow; a black, anteriorly pointed, posteriorly forked nuchal spot evident only in the young. . . . . *karlschmidtii*, p. 147

#### 25. *Pseudoxenodon bambusicola* Vogt

##### Figure 32

*Pseudoxenodon bambusicola* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 138.—Mell, 1922, p. 118 (type locality, mountains [of northern Kwangtung] at the Hunan-Kiangsi boundary, 600-900 meters).



—Werner, 1926, Zool. Anz., LXVII, p. 144 (*bambusicola* and *melli* considered as male and female, respectively, of a single species).

*Pseudoxenodon melli* Mell, 1922, l.c., Pl. iv (type locality, Lungtou, northern Kwangtung, 600 meters or over).

—Vogt, 1922, p. 139 (original description of type).—Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 202 (Namkao, Hainan, 300 meters).

*Pseudoxenodon dorsalis melli* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 320 (Kwangsi).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 69 (Lohsiang, Kwangsi).

*Pseudoxenodon dorsalis bambusicola* Mell, 1931, Lingnan Sci. Journ., VIII, p. 205.

*Description*.—Upper labials 8; preoculars single; postoculars 3, rarely 2; anterior temporals 2, rarely 1; posterior temporals 2, rarely 1; scales keeled, oblique, in 19, very rarely 17 rows on the neck, 17 at midbody, and 15, very rarely 13 before the vent; ventrals in males 131-133, females 139-142; subcaudals in males 50-52, females 42-46; total length of males 340+78, 337+76, and 227+49, females 530+94, 339+59, 323+55, 264+47, and 148+26 mm.; elements of color pattern more vividly contrasted in males; dorsal bands on body and tail 15-24. (Description based on eight specimens from Fukien.)

Table XI gives the maxillary counts of three specimens in the American Museum.

TABLE XI. MAXILLARY COUNTS OF *PSEUDOXENODON BAMBUSICOLA* FROM FUKIEN

Locality	Right Side	Left Side	Interval	Amer. Mus. No.
Yenping . . . . .	20 + 2	22 + 2	very small	33407
Yenping . . . . .	23 + 2	22 + 2	very small	35143
Futsing Hsien . . . . .	23 + 2	22 + 2	very small	34098

The confusion caused by Mell in treating the more uniformly colored males as *bambusicola* and the "contrasty" females as *melli* is so great that one is not surprised to find Fan (1931, p. 69) dividing a series of twenty Lohsiang "*melli*" into eleven "males" (ventrals 133-143, subcaudals 52-60) and two "females" (ventrals 138-140, subcaudals 47-52)! Schmidt (1927, p. 439, fig. 16) did not help matters by describing and figuring a "contrasty" specimen from Hainan as a "male" under the name of *melli*. This specimen has 52 subcaudals. Smith's (1923, p. 202) Hainan example has 141 ventrals and 47 subcaudals. It is also a female.

I was fortunately able to settle this whole matter to Mell's satisfaction in Berlin where he kindly showed me ten specimens collected by himself, including the types of both *melli* and *bambusicola*. These divided into two lots, six relatively uniformly colored and four "contrasty" individuals, the former all males, the latter females. It is not necessary to give additional details.

A translation of the original description of the type, a male, follows:

The rostral is visible from above. The nostril lies in the middle of the large nasal. It is

separated from the internasals by a narrow suture. The prefrontals are longer than the internasals, which are strongly narrowed toward the front. The frontal is a little longer than broad and somewhat shorter than the distance from the tip of the snout. The parietals are one and a half times as long as the frontal. The height and breadth of the loreal, which becomes narrower above, are equal. One pre-, 2 postoculars, 2 + 3 temporals are present. Of the 8 supralabials the 4th and 5th enter the eye. Four sublabials are in contact with the anterior

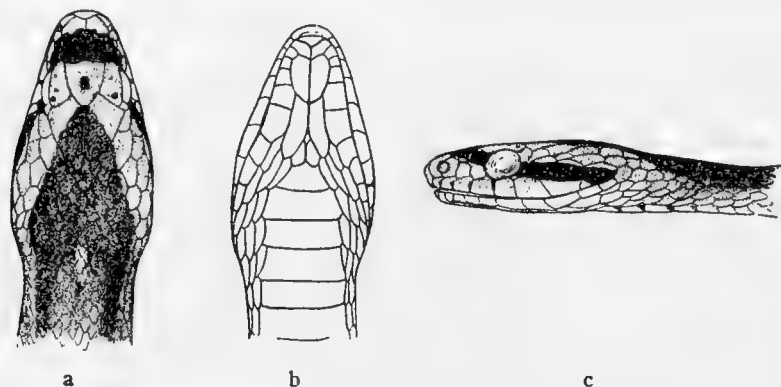


FIG. 32. *Pseudoxenodon bambusicola*. Nat. size. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 27753 from the mountains south of Nodda, Hainan.

chin-shields, which are somewhat shorter than the posterior. The scales are disposed obliquely and weakly keeled; the outer row is smooth. Anteriorly 19, at the middle 17 and near the vent 15 scale rows are present. Ventrals 132, subcaudals 56, anal divided.

The color (alc.) is yellow-brown above, with isolated, indistinct, oblique transverse spots separated by wide interspaces. One small animal has no transverse spots. The tail has a light vertebral line and a light line on each side at the edge of the subcaudals. The characteristic  $\Lambda$ -shaped brown head design begins with the point on the frontal. Its branches are joined by two similarly colored parallel nuchal stripes equalling one and a half head-lengths. The internasals and prefrontals are brown. From the latter a brown stripe, interrupted by the eye, extends to the angle of the mouth. Labials yellowish white without dark margins. The ventral surface is yellowish white with isolated, brown transverse spots. Below the tail is thickly dusted with brown dots. Total length 51 cm., tail 10.5 cm.

The hemipenis is very long and deeply forked. To well beyond the point of forking, it is beset with small, slender, spine-shaped processes, barely if at all stiffened. These processes give way abruptly to a compact group of long spines, which gradually decrease in length, soon merging into calyces with spine-like scallops. The calyces in turn decrease in size, finally becoming minute. The sulcus bifurcates some distance proximal to the forking of the organ and ends in a longitudinal ridge at its tip. The sulcus lips are raised and beset with spine-shaped processes proximally, spines in the spinous region, and calyces in the calyculate area. The groups of large spines distal to the point of forking give each undissected branch of the hemipenis a bulbous appearance, and these enlarged ends do not lie exactly opposite, one being

considerably in advance of the other. (Description based on a specimen from Yenping.)

*Distribution*.—*P. bambusicola* is known only from the following localities:

Kwangtung: Wanszushan and Lungtou.

Hainan: Namkao and the mountains south of Nodoo.

Kwangsi: Lohsiang.

Fukien: Futsing Hsien and Yenping.

*Habits and Habitat*.—Mell (1922, p. 118) found this snake between 600 and 900 meters above sea-level in forests of northern Kwangtung, but it occurs at much lower altitudes in Futsing Hsien, and Smith (1923, l.c.) collected it at 300 meters on Hainan. It is an inhabitant of wooded mountains and seems to be most commonly found in bamboo groves, though this is probably to be explained by the fact that such groves in southern China are frequently kept free of undergrowth, and snakes are consequently easily seen in them. It does not occur in the Kuatun mountains where its place is taken by *P. striaticaudatus*, *karlschmidti* and *fukienensis*.

Mell (1922, l.c.) records finding frogs and lizards (*Lygosoma*) in stomachs of *bambusicola*.

I described its behavior as follows (1929, p. 404):

In handling four of these snakes I detected the following behavior: flattening of neck and part of body; inflation of same; opening of mouth half-way; drawing up or curling of lips; vibrating tail; and an apparent simulation of death by turning on back and lying motionless for some minutes. Only one specimen showed this last behavior but it "played possum" repeatedly. However, when turned on its belly it would not immediately reverse itself as some examples of the genus *Heterodon* will do. Two specimens curled the lips upward but only one vibrated the tail. None could actually be made to bite in spite of the threatening attitude, with mouth partly open.

*Material examined*.—I have seen the following specimens: 8 from Fukien, 1 from Hainan and 1 from an unknown locality, in the American Museum; 1 from Kwangtung (Mell collection), in the British Museum; 10 from Kwangtung (Mell collection), in the Berlin Museum; 1 from Kwangtung (Mell collection) and 1 from Lohsiang, in the Museum of Comparative Zoölogy; and 1 from Lohsiang, in the U. S. National Museum.

#### 26. *Pseudoxenodon dorsalis* (Guenther)

*Xenodon macrophthalmus* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 58 (part: Chekiang).

*Tropidonotus dorsalis* Guenther, 1864, Rept. Brit. India, p. 263 (type locality, Chekiang).

*Pseudoxenodon dorsalis* Boulenger, 1893, Cat. Snakes Brit. Mus., I, p. 271, Pl. xvii.

*Description*.—The original description of the only specimen known, a female, follows:

Head, trunk, and tail of moderate length; eye large. Scales in seventeen rows, much

imbricate, those on the neck and anterior part of the trunk disposed in very oblique rows. Ventrals 143; subcaudals 52. Anterior frontals obtusely rounded in front, more than half as large as posterior. Vertical five-sided, with the lateral margins longest and convergent, and with an obtuse hinder angle. Occipitals not twice as large as vertical. One præocular, just reaching to the upper surface of the crown; three postoculars (two of which are confluent into one on one side of the specimen). Loreal subtriangular, higher than long; eight upper labials, the fourth and fifth entering the orbit, the seventh the largest. Temporals rather irregular, two being in contact with the postoculars. Two pairs of chin-shields, the posterior of which are divergent behind, and rather longer than the anterior, which are in contact with four labials. Each maxillary is armed with twenty small teeth, the last being much larger than the preceding, from which it is scarcely separated by an interspace. Brownish grey, with a vertebral series of about twenty-five rhombic reddish spots, each occupying about four scales; the spots are confluent posteriorly, and continued on the tail as a reddish, black-edged band. An ill-defined blackish band runs along the edge of the ventral shields. Belly with subquadangular blackish spots anteriorly, and punctulated with brown posteriorly; an indistinct arrow-shaped blotch on the crown of the head, separated by a reddish streak from a black band running from the eye to the angle of the mouth. Upper labials with a narrow black hinder edge.

*Distribution*.—The type and only known specimen was collected in Chekiang by Robert Fortune.

*Material examined*.—I have seen the type in the British Museum.

*Remarks*.—Before visiting the British Museum I was convinced that *dorsalis* would prove to be very closely allied to some other Chinese form but a direct comparison of the type with other members of the genus convinced me that I was dealing with a distinct species, or merely a hybrid. Although I am loath to explain away puzzling specimens by calling them hybrids, I must admit that, in the present case, this explanation is a tempting one because of the remarkable way in which the type of *dorsalis* combines the characters of typical *karlschmidti* with those of *striaticaudatus*.

The following comparison of the three forms illustrates this point:

1. The type of *dorsalis* has a lineate tail like that of *striaticaudatus* but dorsal blotches like those of *karlschmidti*.
2. The side of the head of *dorsalis* has a distinct, black, postorbital stripe like juvenile *striaticaudatus*.
3. The head of the type suggests *karlschmidti* in its large eye, deep snout, and general proportions, while its frontal, prefrontals and internasals are decidedly like those of *striaticaudatus*.
4. The ventral and subcaudal counts rather align it with *striaticaudatus* but there is really little choice in these characters.

Rather than attempt to solve prematurely a difficult problem, I am merely assigning *dorsalis* to an isolated place in the genus until additional material from Chekiang becomes available. I am convinced that more new forms await discovery in China, so there is no harm in postponing a final analysis of the

genus. The suggestion that *dorsalis* may be a hybrid is only a remote possibility and should not be taken too seriously.

Mell (1931, p. 205) has attempted to reduce *bambusicola* and *striaticaudatus* to the rank of subspecies of *dorsalis*, but, until *dorsalis* is more thoroughly understood, such a procedure is of course unwise. Moreover, *bambusicola* and *striaticaudatus* can never be treated as subspecies of the same form because they are more distinct than most species commonly recognized as such by herpetologists.

It is impossible to say just where Werner's (1909, p. 214) two specimens of "*dorsalis*" belong. The question is of little importance anyway because one of them is from an unknown locality, while Canton is given as the origin of the other. This is doubtless a "blanket" locality.

#### 27. *Pseudoxenodon fukienensis* Pope

##### Figure 33

*Pseudoxenodon fukienensis* Pope, 1928, Amer. Mus. Novitates, No. 320, p. 2 (type locality, Chungan Hsien, Fukien); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 407, fig. 5 (amplified description).

*Pseudoxenodon (sinensis?) fukienensis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 204.

*Description*.—Upper labials 8, very rarely 7; preoculars single; postoculars 3, rarely 4; anterior temporals 2; posterior temporals 2, rarely 3; scales keeled, oblique, in 19 rows on the neck, 17 near midbody and 15 before the vent; ventrals in males 137-143, females 147-148; subcaudals in males 61-65, females 54-57; middorsal light spots 25-29 + 11-16. (Description based on the fourteen paratypes.)

The three largest among the twelve known males measure 493 + 152, 480 + 132 and 478 + 138 (type), the only known females 535 + 125, 502 + 120 and 182 + 44 mm.

Table XII gives the maxillary counts of the type and two paratypes.

TABLE XII. MAXILLARY COUNTS OF *PSEUDOXENODON FUKIENENSIS*

Locality	Right Side	Left Side	Interval	Amer. Mus. No.
Chungan Hsien . . . . .	22 + 2	22 + 2	small	type
Chungan Hsien . . . . .	21 + 2	21 + 2	small	34643
Chungan Hsien . . . . .	21 + 2	21 + 2	small	34652

There is no real ontogenetic color change in this species, but the colors of the young are very distinct and noticeably more contrasted than those of the adult.

In the mature males, the keels of the scales in the cloacal region have poorly developed knobs.

The original description of the type, a male, follows:

Rostral broader than deep, just visible from above; internasals shorter than prefrontals; frontal much longer than broad, as long as its distance from end of snout, slightly shorter than parietals, which are as long as their distance from internasals. Loreal deeper than long; preoculars 1-1; postoculars 3-3; both anterior and posterior temporals 2-2; upper labials 8-8, fourth and fifth entering eye. Four pairs of lower labials in contact with anterior chin-shields.

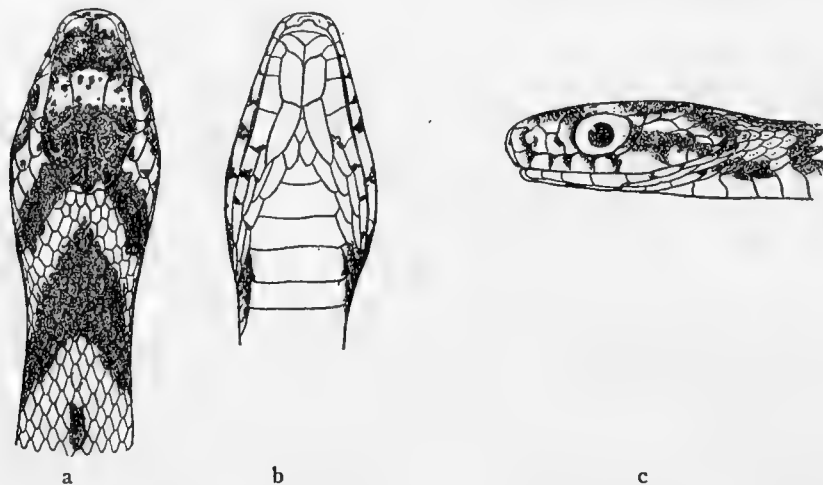


FIG. 33. *Pseudoxenodon fukienensis*. Type.  $\times 2$ . a. Dorsal view of head and neck. b. Ventral view of head. c. Lateral view of head.

Scale formula 19-17-15, the reduction from 19 to 15 taking place so abruptly at midbody that the section covered by 17 rows is equal only to width of some 20 ventral plates; at midbody all scale rows keeled. Ventrals 138; anal divided; subcaudals 62; total length 616 mm., 0.22 occupied by tail.

Fundamentally, the dorsal color pattern is strikingly like that of the other *Pseudoxenodons*, but actually it is distinct because of the different values of the component parts. The rather faint, middorsal light spots, 36 in number, are black-bordered before and behind, and from side to side cover 3 or 4 scale widths, while longitudinally they cover the length of a scale. The lateral black spots fall opposite the central light ones and are about twice as large. There is a purplish tinge to the ground color along the sides that is lacking down the middle of the back. On the tail only the light spots, 15 in number, predominate, for there the rest of the pattern is obscure. The ventrum has the usual dark speckling which is almost lacking on the first score of ventral plates. . . . The speckling is proportionately less concentrated laterally, but the individual spots tend to run together along the base of each plate, and, posteriorly, across the center. The greatest profusion of speckles is reached before the anus, for behind it they are only moderately profuse and almost lacking along the juncture of the divided subcaudal plates. The top of the head is black except for a gray interocular band and a gray temporal stripe irregular in outline extending from the eye to a little above the angle of the mouth. The side of the head between the eye and nasal opening is also gray, as is the rostral plate. At the sutures between each of the first 5 upper labials is a wedge-shaped, black spot directed downward. A postocular stripe, just below the temporal one described above, borders the sixth and crosses the last 2 upper labials, sending a point down-

ward at the suture between the sixth and seventh. There is a very conspicuous V-shaped, black band across the neck whose apex reaches almost to the parietals.

The hemipenis is forked opposite the eleventh subcaudal plate but extends to the sixteenth to seventeenth. The organ is spinous proximally, the spines being small and uniform to the point of forking. They increase in length beyond this point, but are soon supplanted by much larger, thicker ones. These large spines in turn decrease in length very rapidly, soon attaining a marked degree of uniformity. After this, they gradually decrease in size to the tip of the organ. Following the rapid decrease in length, the spines become arranged in more or less connected rows across the hemipenis, suggesting calyces in appearance. The sulcus divides some distance proximal to the point of forking, finally ending in a longitudinal ridge near the tip of the organ. The lips of the sulcus are generally spinous. The groups of large spines distal to the point of forking give each undissected branch of the hemipenis a slightly bulbous appearance, and these enlarged ends do not lie exactly opposite, one being slightly in advance of the other. (Description based on the type.)

*Distribution*.—*P. fukienensis* is known only from the type locality, in northwestern Fukien.

*Habits and Habitat*.—This species was found only in the high, forested mountains about Kuatun and Sanchiang where it was not rare (Pope, 1929, p. 409).

Frog remains were found in the stomach of one individual (Pope, 1929, l.c.).

One female held 3 well-developed, elongate eggs, a superficial examination of which failed to reveal embryos, a fact that may be taken as an indication of oviparity. One egg measured 47 x 13 mm. (Pope, 1929, l.c.)

When annoyed, *fukienensis* flattens its neck but makes only feeble attempts to bite (Pope, 1929, l.c.).

*Material examined*.—The only known specimens, 15 in number, were collected by me for the American Museum.

## 28. *Pseudoxenodon karlschmidti karlschmidti* Pope

Figure 34

*Pseudoxenodon dorsalis* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 520 (Yenping, Fukien) (not of Guenther, 1864).

*Pseudoxenodon karlschmidti* Pope, 1928, Amer. Mus. Novitates, No. 320, p. 3 (type locality, Chungan Hsien, Fukien); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 410, figs. 6 and 7 (amplified description).

*Description*.—Upper labials 8, very rarely 7; preoculars single; postoculars 3; anterior temporals 2; posterior temporals 2, very rarely 3; scales keeled, oblique, in 19 rows on the neck, 17 near midbody, and 15 before the

vent; ventrals in males 144-151, females 149-153; subcaudals in three males 58-60, in three females 54-56; middorsal light spots 20-25 + 8-10. (Description based on the seven paratypes.)

The measurements of the eight known specimens follow: males, 625 + 131 +, 290 + 68, 255 + 60, and 209 + 47 mm.; females, 653 + 143 (type), 540 + 120, 254 + 54, and 199 + 44 mm.

Table XIII gives the maxillary counts of the type and two paratypes.

TABLE XIII. MAXILLARY COUNTS OF *PSEUDOXENODON KARLSCHMIDTI* KARLSCHMIDTI

Locality	Right Side	Left Side	Interval	Amer. Mus. No.
Chungan Hsien . . . . .	26 + 2	26 + 2	very small	type
Chungan Hsien . . . . .	26 + 2	26 + 2	very small	34659
Chungan Hsien . . . . .	27 + 2	26 + 2	very small or absent	34660

In the mature male, the keels of the scales in the cloacal region have poorly developed knobs.

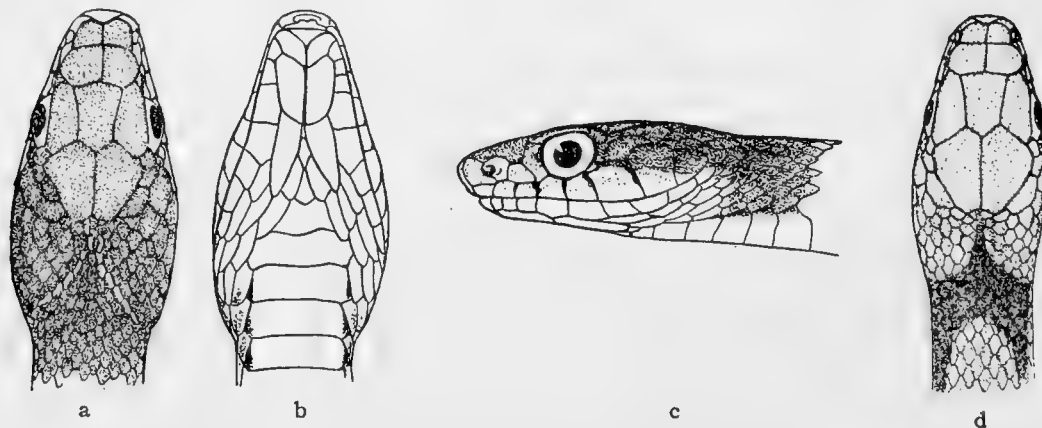


FIG. 34. *Pseudoxenodon karlschmidti karlschmidti*. Type  $\times 2$  and paratype  $\times 4$ . a. Dorsal view of head of type. b. Ventral view of head of type. c. Lateral view of head of type. d. Dorsal view of head of juvenile paratype.

The original description of the type, a female, follows:

Rostral broader than deep, just visible from above; internasals much shorter than prefrontals; frontal much longer than broad, barely as long as its distance from end of snout, just as long as parietals, which are much less than twice as broad in front as behind. Loreal deeper than long; preoculars 1-1; postoculars 3-3; anterior temporals 2-2; posterior 2-3. Upper labials 8-8, fourth and fifth entering orbit; lower labials 9-10; four in contact with anterior chin-shields on one side, 5 on other. Scales reduced from maximum of 19 to minimum of 15 at midbody, consequently, count of 17 extends along a distance equal to width of only some



six ventrals. Ventrals 154; anal divided; subcaudals 56; total length 796 mm., 0.18 taken up by tail.

The ground color of the dorsum is blackish gray. Down the middle of the back are 24 light gray spots. From side to side each spot covers the width of 4 to 6 scales, but longitudinally only the length of one. Some of these spots lie obliquely and all are surrounded by scales part black and part gray. Anteriorly on either side is a very indistinct row of darkish spots made up of black-bordered scales. These darkish spots for the most part alternate with the middorsal spots. The majority of the dorsal scales have minute traces of black. The light, middorsal row of spots extends on to the tail where there are 5 distinct and 2 indistinct ones. There the black borders are very indistinct. Beginning about 20 plates from the chin-shields, the ventrals are speckled with black more and more profusely toward the tail under which the speckling is so profuse that the subcaudals appear black. Laterally the speckles are concentrated along the tips of the ventrals to form a line, while in general they are gathered along the bases of the scales. The tips of even the first 20 plates are black. The ventral surface of the head is immaculate. The temporal region is darker than the dorsal surface of the head but there is no distinct postocular band. All but the last 2 upper labials on either side are narrowly bordered with black behind.

This species has a juvenile color pattern generally more vivid than and somewhat distinct from that of the adult. In the juvenile, the black bars at either end of the light middorsal spots are very evident and the top of the head is reddish brown instead of blackish gray as in the adult. On the neck there is a strong, black spot with a point projecting forward to the tips of the parietals, and a lateral posterior projection on either side of the neck. This blotch is entirely lacking in the larger adult. (Pope, 1929, p. 411.)

Unfortunately, the hemipenis of this form cannot be described in detail because it is badly damaged in the only adult male. The organ belongs, however, to the same general type as that of *striaticaudatus*, differing, nevertheless, in some minor, and two major details as follows:

1. The spines of the group beginning just distal to the point of forking are much more slender in *karlschmidti* than in *striaticaudatus*.

2. In *karlschmidti*, the region proximal to the point of forking is beset with relatively few, short, papilla-like processes, only the more distal of which are tipped by minute spines, one spine to each process. This region in *striaticaudatus* bears very numerous, small spines.

*Distribution*.—This form is known only from the type locality and Yenping, both in Fukien.

*Habits and Habitat*.—*P. karlschmidti karlschmidti* was collected by me only in the high, forested mountains about Kuatun and Sanchiang. Caldwell probably secured his specimen in the Yenping mountains.

Remains of frogs were found in the stomachs of two Chungan Hsien specimens.

*Material examined*.—I have seen the type, 6 paratypes and a Yenping specimen, all in the American Museum. The latter was erroneously considered a paratype by me in 1929 (l.c.).

29. *Pseudoxenodon karlschmidti sinii* Fan

*Pseudoxenodon macrops* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 117 (600-1000 meters at the following Kwangtung localities: Lofaoshan; Lungtou; Chayuanshan; Wanszushan; Chiufeng) (not of Blyth, 1854).

*Tropidonotus tigrinus niger* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 138 (part).

*Pseudoxenodon sinii* Fan, May 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 72, fig. 3 (type locality, Lohsiang, Kwangsi).

*Pseudoxenodon angusticeps sikiangensis* Mell, July 1931, Lingnan Sci. Journ., VIII, p. 204 (type locality, Kwangtung).

*Description*.—The present form differs from the typical one chiefly in ventral and subcaudal counts as shown by the following figures for Fan's (1931, pp. 74 and 75) Yaoshan specimens: ventrals in males 157-162, females 154-158; subcaudals in males 67-70, females 64-66. Mell's counts for *sikiangensis* (ventrals 153-159; subcaudals 56-65) reduce the gap somewhat, a fact not surprising in view of the geographical relationship of Kwangtung to Kwangsi and Fukien.

The maxillary teeth of Mell's Chiufeng juvenile are not easily counted but there appear to be 26 or 27 + 2 on one, 25 or 26 + 2 on the other side.

The original description of the type, a male, follows:

Rostral broader than deep, visible from above; internasals five sixths as long as and broadly in contact with the prefrontals; the latter also touching postnasal, loreal, preocular, supraocular and frontal; frontal longer than broad, longer than the internasal and interpre-frontal sutures together, as long as interparietal suture; parietals very narrow behind, much less than half [as] wide [as] in front. Nasal divided; nostrils round, on posterior portion of anterior nasal; loreal higher than long; preocular 1-1; postoculars 3-3; temporals 2 + 3-2 + 3; supralabials 8-8, fourth and fifth entering eye; lower labials 10-10, first five in contact with the anterior pair of chin-shields, which is shorter than the posterior pair. Scales in 21-19-17-15 rows, all keeled except the outmost row; 162 ventrals; anal divided; subcaudals 66 pairs.

In formalin, general colour is dark bluish gray above, bluish white below, speckled with dark seal brown on the posterior [part]. Upper head bluish olive, labial region pale 'flesh colour.' An oblique whitish line directed downward and backward on either side of the nape. 22 roundish light bluish gray spots along the mid-dorsal line on back and 9 on tail. Each spot covers two or three scale lengths long and four to seven scale rows wide; bordered by indistinct dark bands before and behind. The bordering being totally wanting on tail. A lateral series of more or less indistinct dark olive brown spots on either side of the body just below the mid-dorsal spots; alternating with these is still another series of more faint spots, which are only traceable on anterior body. Front third of the trunk with ventrals marked by squarish dark chocolate brown spots. Ventrals all densely powdered with dark purplish brown on their angles, forming a well-defined lateral line. Total length, 555 mm.; snout to vent, 432; vent to tip of tail, 123.

Fan (1931, p. 73) describes a juvenile male paratype from the type locality as follows:

. . . dusky brown above, darker medially, with 25 bluish white spots across the back. Each spot covers two or three scale lengths long and five to seven scale rows wide, bordered

distinctly by black brown on both ends; the bordering being nearly as broad as the spots themselves, heavier on posterior body, whereas they are accompanied by two alternating series of lateral black spots on both sides; the lateral spots as well as the borderings are totally lost on the tail, where they are only represented by 8 bright median spots. A very distinct inverted U-shaped spot with a pointed apex resting behind the interparietal suture. A slender short black streak on either side of neck accompanying.

*Distribution*.—This form is known only from the following localities:

Kwangsi: Lohsiang; Kuchen.

Kwangtung: Lofaoshan; Lungtou; Chayuanshan; Wanszushan; Chiufeng.

*Habits and Habitat*.—Mell (1922, p. 117) gives the vertical range of this subspecies in Kwangtung as 600-1000 meters and records it from forested mountainous country. Fan's material was presumably taken in a similar type of country.

*Material examined*.—I have seen a juvenile male collected by Mell in extreme northern Kwangtung at Chiufeng, north of Lokchong.

*Remarks*.—The structure of the hemipenis and the presence of 26 teeth on one maxilla of Mell's Chiufeng example show beyond a doubt that its alliance is with *karlschmidti* and not with *macrops* as believed by Mell. There are other characters that substantiate this conclusion. Moreover, Fan (1931, p. 72) remarks on the similarity of the pattern of his Lohsiang material to that of *karlschmidti*.

### 30. *Pseudoxenodon macrops* (Blyth)

*Tropidonotus macrophthalmus* Guenther, 1892, in Pratt's Snows of Tibet, p. 241 (Kiating, Szechwan); 1896, Ann. Mus. Zool. Acad. Sci. St. Pétersbourg, I, p. 206 (Tatsienlu, Hsikang).

*Pseudoxenodon macrops* Mocquard, 1897, Bull. Mus. Hist. Nat., Paris, III, p. 215 (Tseku, Yunnan).—Werner, 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 46 (between Yungning, Yungpeh and Likang, Yunnan).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 519 (Tengyueh, Yunnan).—Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 46, fig. 13 (Yenchinghsi, Opien Hsien, Szechwan, 1040 meters).

*Pseudoxenodon sinensis* Boulenger, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 134 (part).—Barbour, 1912, Mem. Mus. Comp. Zool., XL, p. 131 (part: Laolingkung, Hsikang, 10,300 feet).—Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 49, fig. 14 (Hungchuangping of Mt. Omei, Szechwan, 1300 meters).

*Tropidonotus handeli* Werner, 1922, Anz. Akad. Wiss. Wien, LIX, p. 221 (type locality, Likang, Yunnan); 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 45 (amplified description).

*Tropidonotus tigrinus niger* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 138 (part).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 116 (part: Yunnan).

*Tropidonotus tigrinus* Vogt, 1924, Zool. Anz., LX, p. 339 (part: Washan, Szechwan); 1927, LXIX, p. 283 (part).

*Pseudoxenodon macrops sinensis* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 76 (Wenchwan, Szechwan).

*Natrix handeli* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 514, fig. 10 (Likang, Yunnan).

*Description*.—(See *P. macrops macrops* and *macrops sinensis*.)

In adult males from Szechwan, the keels of the scales in the cloacal region have knobs.

The hemipenis is forked opposite the eleventh subcaudal plate but extends

to the fifteenth to sixteenth. The organ is spinous proximally, the spines being small and nearly uniform in size. These small spines persist to just beyond the point of forking, where they are supplanted by large, very thick ones, each surmounted by a slightly curved, sharp tip. These large spines in turn rapidly decrease in length and increase in number until a certain degree of uniformity is reached. After this, they gradually decrease in size to the tip of the organ. The sulcus divides some distance proximal to the point of forking, finally ending in a longitudinal ridge near the tip of the organ. The lips of the sulcus are generally spinous. The groups of large spines distal to the point of forking give each undissected branch of the hemipenis a slightly bulbous appearance, and these enlarged ends do not lie exactly opposite, one being slightly in advance of the other. (Description based on a specimen from Tengyueh.)

*Habits and Habitat*.—The stomach of a specimen in the American Museum from Tengyueh contains the remains of a polypedatid frog almost certainly of the genus *Polypedates*.

*Material examined*.—I have examined the type of *Tropidonotus handeli*, in the Naturhistorisches Museum, Vienna, and that of *Tropidonotus tigrinus niger*, from Yunnan, in the Berlin Museum. Through the generosity of Dr. Stejneger, I was also allowed to study the Szechwan specimens listed in Table XIV and preserved in the U. S. National Museum. Neither of these has been previously recorded in the literature.

TABLE XIV. VENTRAL, SUBCAUDAL AND UPPER LABIAL COUNTS OF  
*PSEUDOXENODON MACROPS*

U. S. Nat. Mus. No.	Locality	Sex	Ventrals	Subcaudals	Upper Labials	Labials Entering Orbit
76259	Yachow	♂	155	65	7	3-4
76260	Yachow	♂	163	69	8	4-5

*Remarks*.—The above synonymy refers to records based on material that cannot with absolute certainty be placed under either one of the two subspecies of *macrops*. The difficulty in placing this material is entirely due to lack of sufficient data, not to lack of material and records. Unless the sex, upper labial and ventral counts are given, it is impossible to allocate any particular individual. It is also advantageous to know which labials enter the orbit.

In spite of the fact that many figures are available, it is impossible to get all the necessary data on more than a very few individuals from Szechwan and western Yunnan. If it were not for the surprising sexual difference in ventral counts (Schmidt, 1927, p. 520), there would be no difficulty. I simply cannot

arrive at final conclusions through a study of the literature as it stands today but can only conclude that *macrops sinensis* and *macrops macrops* intergrade in western Yunnan and parts of Szechwan and Hsikang. In order to make the matter as clear as possible and still remain on firm ground, I have given three sets of synonymy which not only summarize the literature but give the localities from which *macrops* has been recorded in China.

It is only fair to remark, however, that the actual sexual difference in ventral counts referred to just above is not as great as indicated by Schmidt's figures. This fact is proved by four Yunnanfu males in the Museum of Comparative Zoölogy with 145, 147, 148 and 152 ventrals.

### 31. *Pseudoxenodon macrops macrops* (Blyth)

*Tropidonotus macrops* Blyth, 1854, Journ. Asiat. Soc. Bengal, XXIII, p. 296 (type locality, Darjeeling, Bengal).

*Tropidonotus angusticeps* Blyth, 1854, Journ. Asiat. Soc. Bengal, XXIII, p. 295 (type localities given as Assam and Arakan, but later restricted to Arakan by Slater because of inclusion of two species).

*Xenodon macrophthalmus* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 58 (part: all but Chekiang).

*Tropidonotus macrophthalmus* Guenther, 1864, Rept. Brit. India, p. 262, Pl. xxii.

*Tropidonotus Sikkimensis* Anderson, 1871, Journ. Asiat. Soc. Bengal, XL, pt. 2, p. 17 (type locality, Darjeeling, Bengal).

*Pseudoxenodon macrops* Boulenger, 1890, Fauna Brit. India, p. 340.—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 74 (fifty miles west of Tatsienlu, Hsikang).

*Description*.—The typical form of *macrops* has a decidedly higher ventral count than *sinensis*. There are 8 upper labials, the 4th and 5th entering the orbit, in *macrops macrops*, while in *sinensis*, they are reduced to 7, with the 3rd and 4th touching the eye.

Among fifty-seven specimens from the Darjeeling region, the largest individual, a male, measured 1283 mm. in total length (Wall, 1909, p. 341). In this same reference, Wall describes the variation in color exhibited by his large series from this region.

The original description, apparently based on three specimens, follows:

Eye very large; the vertical shield broad, and posterior frontals twice as large as the anterior. Prevailing hue of the upper-parts a dull vinaceous, many of the scales margined with black, and some with yellow: a series of yellow spots (about 50 in number) continued along the spine to the extremity of the tail, with a row of black spots on either side. Head and neck plumbeous, diverging on the nape where the first of the series of yellow spots is placed; a slight whitish V-like mark on occiput. Lower parts yellowish-white, with specks and powdering of dusky; more prevalent towards and upon the tail. Seventeen ranges of scales: scutæ 164-6; scutellæ 130-46 pairs. Length of largest specimen 31 in., of which tail  $6\frac{1}{4}$  in. Two specimens closely resemble, but a third presents some differences of colour. The row of yellow spots is wanting along the spine, also the dark band on the nape, and the pale V-like occipital mark: the under-parts also are more uniformly whitish. Scutæ 168; scutellæ 124 pairs only.

Blyth's counts for "scutellæ" must refer to the total number of *halves* of subcaudals, i.e., twice the number of subcaudals as normally counted.

*Distribution*.—*P. macrops macrops* is distributed from Nepal eastward through Assam. From Assam it ranges southward to the Southern Shan States and Tenasserim. It has also been found at Ngoi-Tio, northern Tongking. Although, as discussed elsewhere, its distribution in Yunnan and that part of western China lying north of Yunnan is not clearly understood, this subspecies is known to occur in eastern Hsikang and may be expected in southern Yunnan as well.

*Habits and Habitat*.—Annandale (1912, pp. 49 and 53) states that this snake is of common occurrence in the Darjeeling district up to 5000 feet. Wall (1909, pp. 337 and 341) confirms this statement but indicates that *macrops* is not rare up to approximately 6000 feet in this same region.

Wall (1909, p. 341) records finding a frog in the stomach of a specimen from the Darjeeling district and I have found the same in another Darjeeling example.

Venning (1911, p. 772) reports a gravid female taken in the Chin Hills May 20. It held 6 eggs in which the embryos were undeveloped, the largest egg measuring 12.6 x 38.1 mm.

The behavior of a captive specimen is described by Wall (1909, l.c.) as follows:

One brought to me by Dr. Seal had been encountered in his garden, and when disturbed struck fiercely at him with erect, and flattened neck. The degree to which this snake flattens its neck is very marked, being more pronounced, I think, than in any of the *Tropidonoti* with which I am acquainted.

### 32. *Pseudoxenodon macrops sinensis* Boulenger

Figure 35

*Pseudoxenodon sinensis* Boulenger, 1904, Ann. Mag. Nat. Hist., (7) XIII, p. 134 (type locality, Yunnanfu) (? part).—Barbour, 1912, Mem. Mus. Comp. Zool., XL, p. 131 (part: Yunnanfu).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 520 (twenty-two specimens recorded from near Yunnanfu but one of these, No. 17401, was actually collected "six days north" of that city).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 413, fig. 8 (Hsinkai, Yunnan).

*Description*.—Upper labials 7, scarcely ever 8, normally 3rd and 4th to eye; preoculars single; postoculars 3; anterior temporals 2; posterior temporals 2 or 3, rarely 1; scales keeled, oblique, in 19 rows at midbody, 15 before the vent; ventrals in eight males 138-146, in fourteen females 149-162; subcaudals in seven males 60-68, in fourteen females 57-66. Color extremely variable but usually much like that of juvenile *karlschmidti karlschmidti*; occasional melanistic specimens so dark that only the light middorsal spots remain obvious and even these may almost disappear. (Description based on twenty-one specimens from near Yunnanfu, the type locality, and one from "six days north" of this city.)

Eight upper labials do not occur a single time among nine additional

specimens from Yunnanfu examined by me, five in the Museum of Comparative Zoölogy, and four in the British Museum. In spite of the numerous puzzling specimens found in Szechwan and western Yunnan, as discussed elsewhere, the counts just given prove beyond any doubt the existence of a pure culture of *sinensis* in eastern Yunnan.

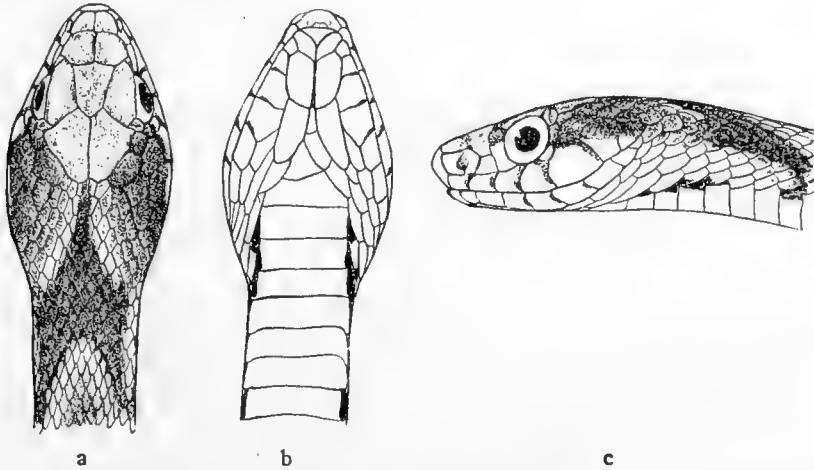


FIG. 35. *Pseudoxenodon macrops sinensis*.  $\times 2$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 12791 from near Yunnanfu.

Table XV gives the maxillary counts of two specimens in the American Museum.

TABLE XV. MAXILLARY COUNTS OF *PSEUDOXENODON MACROPS SINENSIS* FROM YUNNAN

Locality	Right Side	Left Side	Interval	Amer. Mus. No.
near Yunnanfu. . . . .	21 + 2	22 + 2	very small	12791
near Yunnanfu. . . . .	19 + 2	19 + 2	not appreciable	17401

*Distribution*.—Yunnanfu may be taken as the center of the range of *sinensis*. Material from Tungchwan is also quite typical. Its range undoubtedly extends northward into Szechwan and westward in Yunnan but, as yet, cannot be defined with accuracy. It is a safe guess that *sinensis* occurs chiefly on the Yunnan plateau.

*Habits and Habitat*.—The presence of *P. macrops sinensis* on the Yunnan plateau is indication of its preference for altitudes approximating 6000 feet.

The stomach of one Yunnanfu specimen in the American Museum contains the remains of a tree toad (*Hyla*), that of another, from the same locality, the legs of a brevicipitid toad.

Mell (1929, pp. 252, 256 and 257) includes *sinensis* among the snakes that, when annoyed, bring bright colors into sudden view by rearing and flattening horizontally the anterior part of the body.

*Material examined*.—I have seen, in addition to others, the 2 Yunnanfu specimens upon which Boulenger, in part, based his original description.

U. S. National Museum No. 79720 from Yaochi, near Muping, Szechwan, 8600 feet, is a male with 133 ventrals, 58 subcaudals, and 7 upper labials, the 3rd and 4th entering the orbit.

*Remarks*.—Stejneger (1925, p. 76) has wisely restricted the type locality of *sinensis* to Yunnanfu.

There is little doubt that both of Boulenger's original specimens are female, instead of one being a male and the other a female, as recorded by him.

### 33. *Pseudoxenodon striaticaudatus* Pope

Figure 36

*Pseudoxenodon striaticaudatus* Pope, 1928, Amer. Mus. Novitates, No. 320, p. 4 (type locality, Chungan Hsien, Fukien); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 405, figs. 3 and 4 (amplified description).

*Pseudoxenodon dorsalis striaticaudatus* Mell, 1931, Lingnan Sci. Journ., VIII, p. 205.

*Description*.—Upper labials 8, occasionally 7; preoculars 1, rarely 2; postoculars 3, very rarely 4; anterior temporals 2, very rarely 1; posterior temporals 2, very rarely 1; scales keeled, oblique, in 19 or 17 rows on the neck, 17 near midbody, and 15 before the vent; ventrals in nine males 140-144, in eleven females 146-153; subcaudals in eight males 59-64, in ten females 52-62. (Description based on the twenty paratypes.)

The four largest among the nine known males measure 676 + 172, 625 + 148, 620 + 162, and 575 + 151 mm., while the measurements of the four largest of the twelve known females are 635 + 141 (type), 614 + 138, 571 + 142 and 550 + 131 mm. In this species, the males apparently attain the greater size, a fact worthy of special note. (Pope, 1929, pp. 362 and 406.)

Table XVI gives the maxillary counts of the type and two paratypes.

TABLE XVI. MAXILLARY COUNTS OF *PSEUDOXENODON STRIATICAUDATUS*

Locality	Right Side	Left Side	Interval	Amer. Mus. No.
Chungan Hsien . . . .	23 + 2	23 + 2	small	type
Chungan Hsien . . . .	22 + 2	22 + 2	small	34674
Chungan Hsien . . . .	21 + 2	21 + 2	small	34675

In the adult male, the keels of the scales in the cloacal region may or may not have knobs. The knobs at best are very poorly developed.



The original description of the type, a female, follows:

Rostral much broader than deep, just visible from above; internasals slightly shorter than prefrontals; frontal longer than broad, as long as its distance from the rostral, shorter than the parietals which are twice as broad in front as behind. Loreal deeper than long; preoculars 1-1; postoculars 3-3; both anterior and posterior temporals 2-2. Upper labials 8-8, fourth and fifth entering eye; lower labials 9-10, four in contact with anterior chin-shields on one side, 5 on the other. Nineteen rows of scales on neck, 17 from neck to midbody, 15 from middle of body to anus; at midbody all but 3 rows on either side feebly keeled. Ventrals 148; anal divided; subcaudals 55. Total length 776 mm., tail 0.18 of total.

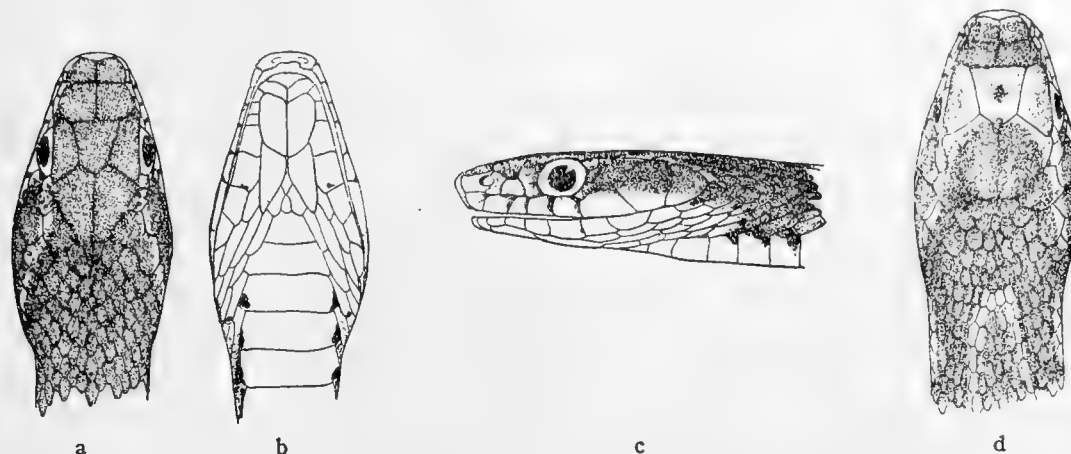


FIG. 36. *Pseudoxenodon striaticaudatus*. Type  $\times 2$  and paratype  $\times 4$ . a. Dorsal view of head of type. b. Ventral view of head of type. c. Lateral view of head of type. d. Dorsal view of head of juvenile paratype.

The dorsum is an obscure, intricate mixture of black and gray, blending on the neck to give a uniformly dark appearance but arranged along the midregion to form indistinct, black-bordered, diamond-shaped spots reaching to the second scale row on either side. Most of the scales not entering this pattern are gray, many others are gray but bordered with black, while a few are entirely black. From a point a tail's length anterior to the anus a black-bordered, middorsal, light gray stripe extends to tip of tail. This is the most conspicuous marking on the dorsum. The light ventrum is profusely spotted with black. The spots run together laterally to form a black band and centrally are most numerous along the anterior edge of each plate. The spots are varied in size and shape and hazy in outline. They are present only on the tips of the first few ventrals. There is a dark line from behind the eye to the angle of the mouth while all but the last 2 upper labials are black-bordered posteriorly. The ventral surface of the head is milky white.

The color pattern is vivid in the juveniles but essentially the same as in the adult, the difference being in the much greater intensity of the black parts of the pattern in the young. In the adult there is a strong tendency for the darker blotches to blend with the gray ground color, each scale losing much of its black. The contrast is greatest on the neck where the young are vividly barred, the adult almost uniformly gray. There is a faint, reddish interocular bar in the smallest examples. Only the upper labial sutures below and anterior

to the eye are black, there being less black on the lip in this species than in *karlschmidti*. (Pope, 1929, p. 407.)

The hemipenis is forked opposite the fourteenth to fifteenth subcaudal plates but extends to the nineteenth. Proximally, it is spinous, the spines being small, uniform in size, and not very stiff. These small spines persist about to the point of forking, beyond which they are soon supplanted by much larger, curved spines, set in a compact mass along both sides of the sulcus, and gradually decreasing in size distally until they, in turn, are supplanted by an area of calyces with deeply scalloped, thick, spine-like edges. These calyces, in contrast to the spines just preceding them, extend across the entire width of the organ and become minute at its extreme tip. The sulcus, whose lips are spinous basally, bifurcates some distance proximal to the point of forking. It ends near the tip of the organ at the base of a calyculate, longitudinal ridge. The groups of large spines distal to the point of forking give each undissected branch of the organ a slightly bulbous appearance, and these enlarged ends do not lie exactly opposite, one being very slightly in advance of the other. (Description based on a specimen from the type locality.)

*Distribution*.—*P. striaticaudatus* is known only from the type locality, in northwestern Fukien.

*Habits and Habitat*.—This species was found in the high, forested mountains about Kuatun and Sanchiang where it was not rare.

*Material examined*.—The only known specimens, 21 in number, were collected by me in Chungan Hsien.

*Remarks*.—The present species is obviously very closely allied to *stejnegeri* Barbour, 1908, p. 317, described from Mt. Arizan, central Formosa. In fact, when the ventral and subcaudal counts of the two forms are compared regardless of sex, the overlapping is so great that some would unite them, but, when sex is taken into consideration, the difference in ventral counts is marked, as shown by Table XVII.

TABLE XVII. COMPARISON OF VENTRAL AND SUBCAUDAL COUNTS OF *PSEUDOXENODON STRIATICAUDATUS* AND *P. STEJNEGERI*

Species	Ventrols		Subcaudals	
	♂	♀	♂	♀
<i>striaticaudatus</i> .....	140-144	146-153	59-64	52-62
<i>stejnegeri</i> .....	150-158	157-162	58-74	55-64

The *stejnegeri* counts are based on the type specimen in addition to the

material recorded by Steindachner (1913, pp. 329-330) and Maki (1931, pp. 52-53).

Although Maki has given the most recent account of *stejnegeri*, the data in his description, key and tables, respectively, do not agree and, moreover, it is impossible to tell which specimens the numbers in his first table represent. It is due to these inconsistencies that the comparison of the forms under discussion cannot be carried further.

I believe that only one valid form of *Pseudoxenodon* has been proved to exist on Formosa, *sauteri* Steindachner, 1913, p. 329, being unworthy of recognition. This conclusion was arrived at only after examination of Steindachner's original material in the Naturhistorisches Museum, Vienna, and the type of *stejnegeri* in the Museum of Comparative Zoölogy.

Mell's (1931, p. 205) treatment of the present form as a subspecies of *dorsalis* is discussed under *dorsalis*.

#### Genus *Helicops* Wagler

*Helicops* Wagler, 1828, Descr. Icon. Amphib., pt. 1, text to Pl. VII (Col.) (type, *Coluber carinicaudus*).

*Atretium* Cope, 1861, Proc. Acad. Nat. Sci. Phila., XIII, p. 299 (type, *A. schistosum*).

As now understood, this genus has a wide distribution with one species in Yunnan, one in India and Ceylon, another in Africa, and several in the New World ranging from Mexico southward through Central America into South America. In *schistosus* (Indian) and *bicolor* (African), the penial spines arise from within calyces but such is not the case in either *angulatus*, *leopardinus*, *modestus*, *polylepis* or *trivittatus*, all of the New World. This would indicate that the New World species are possibly not congeneric with those from the Old World, were it not for the fact that also in *yunnanensis* the spines apparently do not arise from within the calyces. As explained below, the cotype of *yunnanensis* examined by me has been so long preserved that the spines have lost their stiffness and it is even conceivable that other details of structure cannot be clearly made out now, and because of this it will be well to await examination of fresh material before drawing final conclusions. It would likewise be well to collate hemipenes of additional New World forms of *Helicops*. In case the African and Asiatic species in question warrant generic separation, the name *Atretium* Cope is applicable to them.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Color uniform dark olive-brown above, yellow below.

#### 34. *Helicops yunnanensis* (Anderson)

Figure 37

*Atretium schistosum* var. *yunnanensis* Anderson, 1879, Zool. Res. W. Yunnan, p. 822 (type localities, Muangla in the Chanta valley, and Husa, Yunnan, 2000 and 4500 feet).

*Helicops schistosus* Sclater, 1891, List Snakes Ind. Mus., p. 44 (part: Yunnan).

*Helicops schistosus* var. *andersonii* Wall, 1909, Rec. Ind. Mus., III, p. 146 (based on cotypes of Anderson's *yunnanensis*).

*Helicops schistosus yunnanensis* Annandale, 1911, Rec. Ind. Mus., VI, p. 218 (Lungchwan, Yunnan, 3100 feet).

*Description*.—The original description, based on the three cotypes, follows:

The head is of moderate size; snout rather pointed. Body of moderate thickness. The anterior frontals are triangular and form a very short suture with the rostral, but in two cases out of three before me, they are excluded from the rostral by a small azygos shield which is also wedged between them. The posterior frontals are broader than long, and about the same breadth as the anterior frontals. In one out of two, they are united with a notch behind, corresponding to their line of union. In the two, they are divided into three and four pieces. The vertical is long and constricted in the middle, the posterior half tongue-shaped. Occipitals longer than the vertical, rounded behind, sometimes with a portion separated from their hinder extremities. Loreal sub-quadrangular, higher than broad. One preocular reaching to the upper surface of the head. Three postoculars, the lowest in contact with three labials. Temporals 2 + 3; two elongate shields in contact with three postoculars. Nine upper labials, the fourth and fifth orbital. Twenty-three maxillary teeth, increasing in length posteriorly.

#### MEASUREMENTS OF THREE SPECIMENS

No. 1. Length 30.70 inches; head 0.84; tail 7 ? inches.

" 2. " 34.50 " " 0.60; " 6.50 "

" 3. " 24.75 " " 0.62; " 6.58 "

(1) Ventrals 153; sub-caudals 62

(2) " 144; " 80

(3) " 154; " 85

All have nineteen rows of keeled scales.

Colour uniform dark olive-brown above; yellow beneath.

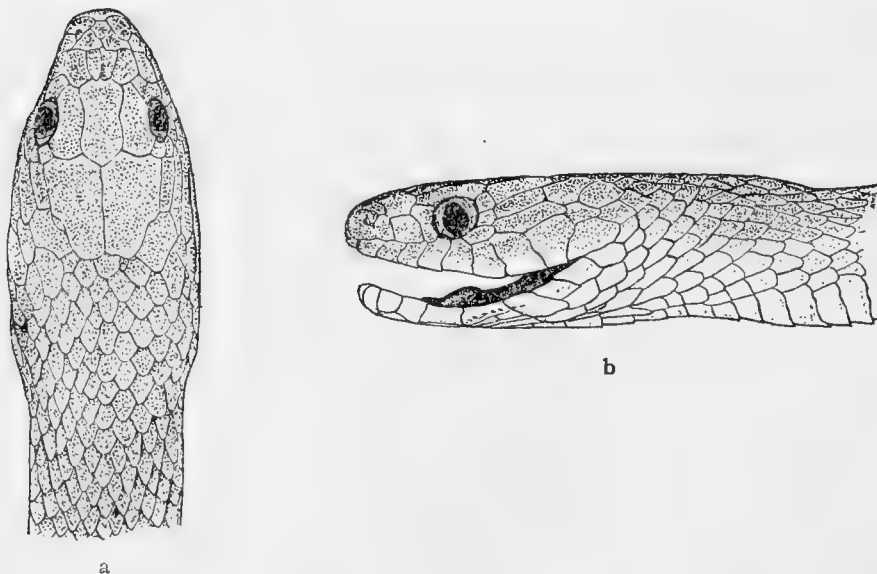


FIG. 37. *Helicops yunnanensis*. Cotype. x 2. Ind. Mus. No. 4196. a. Dorsal view of head. b. Lateral view of head.

The cotype with 62 subcaudals has an imperfect tail, while the one (No. 4196) with 144 ventrals and 80 subcaudals is a male. Its scale formula is 19-17, the reduction taking place just posterior to midbody, and its maxillary count 24-24. Wall (1909, p. 146) has examined the cotypes and remarks that "all three specimens agree in having both the 1st and 2nd supralabials touching the nasals, whereas in the typical *H. schistosus* the 1st only does so." Annandale's (1911, p. 218) Lungchwan ("Mong Wan") example also has the internasal divided into three scales, thus agreeing with two of the cotypes. I fail to see why the present form should be retained as a subspecies of *schistosus* from which it differs so radically. Moreover, Wall (1912, p. 1015, and 1923, p. 608) maintains that true *schistosus* is confined to Peninsular India and Ceylon and therefore its range is not even contiguous to that of the present species.

It is interesting to note that the cotype of *yunnanensis* at hand has perfectly smooth lower labials and chin-shields and no sign of enlarged keels in the cloacal region, while a Ceylon *schistosus* of about equal size has distinct tubercles on the chin-shields and lower labials and enlarged keels in the cloacal region. Both specimens are obviously mature males. The difference described here may possibly be a seasonal one.

The hemipenis of the cotype of *yunnanensis*, No. 4196, extends to the fourteenth subcaudal plate and is forked opposite the tenth. It is beset with numerous, slender processes suggestive of thick hairs which become smaller but more numerous distally. The sulcus does not divide proximal to the point of forking but immediately at it.

It seems certain that the slender processes described above are only spines which have lost their stiffness, for surely, if this supposition is erroneous, the hemipenis of *yunnanensis* is a most extraordinary one. This organ, in a Ceylon *schistosus*, is spinous, but each spine arises from within a shallow calyx, a condition not evident in No. 4196. Making all due allowances for abnormality, or the result of long preservation, I believe that No. 4196 has a hemipenis differing in certain important details from that of the *schistosus* at hand. Wall (1912, p. 1013) has given only a very brief description of the copulatory organ of *schistosus*.

*Distribution*.—*H. yunnanensis* is known only from Muangla, Husa, and Lungchwan, of extreme western Yunnan.

*Habits and Habitat*.—This rare snake has been taken at altitudes of 2000 to 4500 feet.

*Material examined*.—I have seen one of the cotypes (No. 4196) preserved in the Indian Museum.

#### Genus *Macropisthodon* Boulenger

The four valid species of this small, compact genus are found in southern

Asia and the Malay Archipelago. The habit of flattening the body and even rearing like a cobra is characteristic of the genus.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Brown above with large, dark blotches; belly of young black; head broad, distinct from neck, its plates rugose; scales, including those on posterior part of head, and temporals, heavily keeled.

#### 35. *Macropisthodon rudis* Boulenger

Plate VII, A, B, C and D

*Macropisthodon rudis* Boulenger, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 568 (type locality, Tungchwan, Yunnan).—Steindachner, 1913, Denkschr. Akad. Wiss. Wien (math.-natur.), XC, p. 324, figs. 2-4, Pl. II (Formosa).

*Pseudagkistrodon carinatus* Van Denburgh, 1909, Proc. Cal. Acad. Sci., (4) III, p. 51 (type locality, Formosa).

*Natrix namiei* Oshima, 1910, Annot. Zool. Jap., VII, p. 189.

*Macropisthodon rudis melanogaster* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 138 (see under remarks below for type locality).

*Macropisthodon rudis carinatus* Maki, 1931, Monogr. Snakes Japan, p. 55, Pl. xvii (Formosa).

*Description*.—Upper labials 7, rarely 8; suboculars 3, rarely 2; preoculars 3; postoculars 3 or 4, occasionally 2; anterior temporals 3, occasionally 2; scales keeled, with the complete formula 23-21-19, the first reduction taking place posterior to midbody; anal divided, rarely entire; ventrals in six males 133-142, in ten females 145-152; subcaudals in six males 54-58, in ten females 45-50. (Description based on sixteen examples from Chungan Hsien.)

In the young, the belly is black, a fact that led Vogt to describe a juvenile example from the region of Tali as *M. rudis melanogaster*.

The largest females among ten from Chungan Hsien measured from snout to vent 805, 775 and 770 mm., the largest males among six from the same locality 590, 560 and 543 mm. (Pope, 1929, p. 449).

Steindachner (1913, p. 325) has given excellent figures of the skull of *M. rudis*.

The original description of the type, a male, follows:

Maxillary teeth 12 + 2. Rostral once and a half as long as deep, scarcely visible from above; upper head-shields rugose; internasals much broader than long, nearly as long as the præfrontals; frontal once and one fourth as long as broad, slightly longer than its distance from the end of the snout, as long as the parietals; loreal small, deeper than long; three præoculars, four postoculars, and three suboculars separating the eye from the labials; temporals scale-like, strongly keeled; seven upper labials; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales very strongly keeled, in 25 rows. Ventrals 139; anal divided; subcaudals 50. Anterior part of back with large square, transversely elliptic or biscuit-shaped blackish-brown blotches separated by narrow brownish-white interspaces; further back the ground-colour passes gradually to olive-brown, with a median series of round and a lateral series of longitudinally elliptic blackish spots; head blackish-brown above, cream-white on the upper lip and below; belly greyish olive speckled with black anteriorly, blackish speckled with white posteriorly. Total length 590 mm.; tail 160.

The hemipenis extends about to the eighteenth subcaudal plate and is shallowly forked at the tip. Save near the base, it is beset with many more or less continuous, smooth longitudinal ridges, alternating with numerous spines which arise from between the ridges. Basally, there are several large, recurved spines, each forming the proximal termination of a short, fleshy ridge. The lips of the sulcus are most prominent proximally. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—This striking snake is known only from Formosa and the following localities in China:

Fukien: Chungan Hsien (including Kuatun); northeastern Fukien.

Yunnan: Yunnanfu; Tungchwan; Tsangshan; between Yungning, Yungpeh and Li-kiang.

Szechwan: ascent from Yenyuan to Santashan.

*Habits and Habitat*.—I found this snake in Fukien only in the high forests about Kuatun, and records in the literature generally substantiate this evidence that it is a mountain forest inhabitant. Maki (1931, p. 56), however, states that on Formosa it occurs "in grassy places on high mountains."

I have proof that two Kuatun examples fed on toads, while the stomach of a third held numerous large beetles which may be taken as evidence of its having swallowed a toad also. The long posterior maxillary teeth of this snake undoubtedly enable it to seize and devour such tough prey. *M. plumbicolor* of Peninsular India also feeds on toads but takes frogs and even snakes as well (Wall, 1906, p. 4).

Four Chungan Hsien females held, respectively, 18, 22, 23 and 25 advanced eggs (Pope, 1929, p. 449) with scarcely developed embryos, so this species is certainly egg-laying. Two of these gravid specimens were collected between June 12 and July 20. *M. plumbicolor* is also oviparous (Wall, 1906, l.c.).

A large example, when annoyed, threw itself into regular coils, flattening its head, neck, and body until the conspicuous spots stood out boldly and the head, which was drawn back in a most threatening attitude, became arrowhead-shaped. It would make only half-hearted strokes, apparently being satisfied to pose thus. Repeated teasing and handling failed to make it actually bite (Pope, 1929, l.c.).

*Material examined*.—I have seen the following specimens: 16 from Chungan Hsien, in the American Museum; the type and a Fukien specimen, in the British Museum; the type of *melanogaster*, in the Berlin Museum; 1 example from Yunnanfu, in the Museum of Comparative Zoölogy; and 2 specimens from Kuatun, in the U. S. National Museum.

*Remarks*.—Dr. Mell has informed me that the juvenile upon which Vogt based his new form, *melanogaster*, was collected at 2300 meters in the Tsang-

shan not far from Tali and also that Mell's 1922, p. 117, record of this new form from Lungtou, Kwangtung, is erroneous. Confirmation of this last point is found in Mell's recent list (1931, p. 205).

Additional records of this species are much needed.

#### Genus *Opisthotropis* Guenther

*Opisthotropis* Guenther, 1872, Ann. Mag. Nat. Hist., (4) IX, p. 16 (type, *O. atra*).  
*Calamohydrus* Boulenger, 1888, Ann. Mag. Nat. Hist., (6) II, p. 43 (type, *C. andersonii*).  
*Trimerodytes* Cope, 1895, Proc. Acad. Nat. Sci. Phila., XLVI, p. 426 (type, *T. balteatus*).  
*Tapinophis* Boulenger, 1899, Proc. Zool. Soc. London, p. 164 (type, *T. latouchii*).  
*Liparophis* Peracca, 1904, Rev. Suisse Zool., XII, p. 663 (type, *L. bedoti*).  
*Cantonophis* Werner, 1909, Jahresh. Ver. Naturk. Württemberg., LXV, p. 57 (type, *C. praefrontalis*).  
*Paratapinophis* Angel, 1929, Bull. Mus. Hist. Nat., Paris, (2) I, p. 76 (type, *P. praemaxillaris*).

In addition to the species treated in this work, *Opisthotropis* includes *atra* Guenther, of doubtful origin; *spenceri* Smith, of northern Siam; *praemaxillaris* (Angel) and *jacobi* Angel, of Tongking; *rugosa* (Lidth), of Sumatra; and *typica* (Mocquard), of Borneo.

I have examined the type material of Angel's *Paratapinophis praemaxillaris* and determined that his alleged external projection of the premaxillary is an egg-tooth, the cotypes being juveniles with fresh umbilical scars. His species, however, is quite distinct in possessing unusual characters for the genus, namely, well-developed posterior chin-shields, smooth scales and large size.

Boulenger (1893, p. 283) described the maxillary teeth of *Opisthotropis* (composed then of four species, namely *atra*, *andersonii*, *rugosa* and *typica*) as "small, equal, 20-25." The new species discovered since 1893 show that the teeth are best described as subequal rather than simply equal, while Table XVIII proves that the maximum count must be raised to 42.

I can personally vouch for the accuracy of all the counts given in the table except those of *spenceri* and *praemaxillaris*. This genus serves as another illustration of the great confusion that exists over maxillary counts. Of the eight species listed in the table, the number of maxillary teeth has been wrongly recorded for no less than four, and this by several workers, myself among them. These errors are discussed in detail under the various species involved.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Nostrils directed upward, latero-superior; prefrontal single; scales in 17 or 19 rows at midbody, at least weakly keeled posteriorly.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Upper labials thirteen to sixteen, irregular, many divided horizontally; scales in 19 rows throughout. . . . . *kuatunensis*, p. 169
- II. Upper labials not more than eleven, regular, normally not divided horizontally; scales in not more than 17 rows posteriorly



- A. Scales in 19 rows anteriorly and at midbody, reduced to 17 posteriorly; body completely encircled by alternate dark and light bands, the former compound dorsally. . . . . *balteata*, p. 167
- B. Scales nowhere in more than 17 rows; body not banded
1. Ten or eleven upper labials. . . . . *lateralis*, p. 171
  2. Seven to nine upper labials
    - a. Seven upper labials, first directed backward to form a broad contact with the posterior half of the nasal, seventh very long. . . . . *maxwelli*, p. 176
    - b. Eight or nine, rarely seven, upper labials, first vertical, not directed backward, in contact only with anterior part of nasal, last rarely very long
      - (1) Nasal divided below nostril; two or three, rarely one, preoculars (including subpreocular) excluding loreal from eye. . . . . *andersonii*, p. 166
      - (2) Nasal never completely divided below nostril; preoculars usually absent, occasionally one, very rarely two present; loreal generally broadly entering eye. . . . . *latouchii*, p. 173

TABLE XVIII. MAXILLARY COUNTS OF SPECIES OF *OPISTHOTROPIS*

<i>Species</i>	<i>Maxillary Count</i>	<i>Source</i>
<i>kuatunensis</i> . . . . .	39-42	paratype American Museum No. 34434
<i>kuatunensis</i> . . . . .	38-39	paratype American Museum No. 33708
<i>kuatunensis</i> . . . . .	36-36	type
<i>lateralis</i> . . . . .	27	type
<i>lateralis</i> . . . . .	about 27	type or paratype of <i>Tapinophis shini</i>
<i>spenceri</i> . . . . .	25	type
<i>latouchii</i> . . . . .	25-25	American Museum No. 33711 from Chungan Hsien
<i>latouchii</i> . . . . .	24-25	American Museum No. 33295 from Yenping
<i>latouchii</i> . . . . .	23-24	American Museum No. 33299 from Yenping
<i>praemaxillaris</i> . . . . .	20-25	cotypes of <i>Paratapinophis praemaxillaris</i>
<i>maxwelli</i> . . . . .	22 or 23	type
<i>andersonii</i> . . . . .	22	type
<i>balteata</i> . . . . .	21-21	American Museum No. 27751 from Nodoa
<i>balteata</i> . . . . .	20-21	American Museum No. 27752 from Nodoa

It is possible that the loreal may reach the eye occasionally in *andersonii*, data on this point being unavailable to me, and, as stated below, *latouchii* may very rarely (1 count out of 134) have ten upper labials. I have considered it best to construct the key as given above, in spite of these minor possible sources of error.

36. *Opisthotropis andersonii* (Boulenger)

Figure 38

*Calamohyrus Andersonii* Boulenger, 1888, Ann. Mag. Nat. Hist., (6) II, p. 44 (type locality, Hongkong).

*Opisthotropis Andersonii* Boulenger, 1891, Ann. Mag. Nat. Hist., (6) VII, p. 343; 1893, Cat. Snakes Brit. Mus., I, p. 284, Pl. XVIII.—Wall, 1903, Proc. Zool. Soc. London, p. 87 (Hongkong).

*Description*.—Wall (1903, p. 87) has described five specimens collected by him on Hongkong as follows:

Labials are inconsistent in arrangement. There are nine in one specimen on one side, eight in all the rest. The fourth and fifth touch the eye in one specimen on one side, the fifth only touches the eye in two cases on both sides, and in one case on one side, no labials touch the eye in two specimens on one side. Præoculars (including the suboculars of Boulenger) are two in two specimens on both sides, two in two specimens on one side, one in one specimen on one side, and three in one specimen on one side. The anterior chin-shields are in contact with five lower labials in two specimens on both sides, and in one specimen on one side, with four in one specimen on both sides, and in one specimen on one side. Ventrals and subcaudals  $167 + 60$ ,  $149 + 53$ ,  $164 + 59$ ,  $165 + 59$ . Colour uniform dull olive-bluish above, lower half of ultimate row and belly yellow. Lower labials and throat-scales with dull bluish mottling. Sparse mottling beneath tail.

The type has 22 maxillary teeth very slightly increasing in size posteriorly.

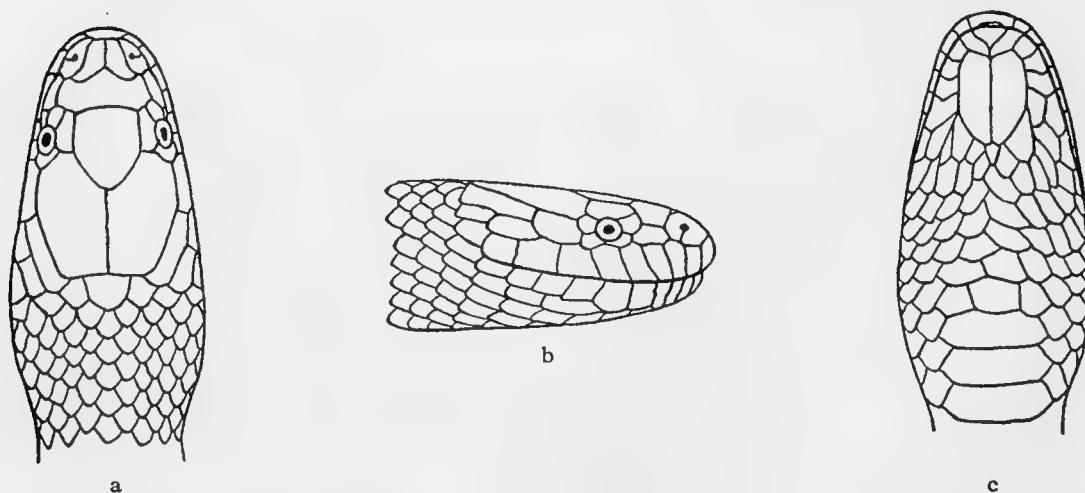


FIG. 38. *Opisthotropis andersonii*. Type.  $\times 4$ . a. Dorsal view of head. b. Lateral view of head. c. Ventral view of head. (After Boulenger.)

The original description of the type, a male, follows:

Præfrontal more than twice as broad as long, in contact with the posterior border of the

nasals and wedged in between the tear-shaped internasals, which form a suture anteriorly; frontal pentagonal, a little longer than broad, and a little shorter than the suture between the parietals; eye surrounded by a small supraocular, which is more than twice as long as broad, a præocular, two suboculars, and a postocular; loreal elongate, more than twice as long as deep, in contact with the third and fourth labials; temporals 1 + 2; eight upper labials, fifth below the eye; nine lower labials, five anterior in contact with the chin-shields, first in contact with its fellow behind the mental; two pairs of chin-shields, anterior large, posterior small and separated by three scales. Scales in seventeen rows, without apical grooves; the keel very feeble, absent on the hinder third of the scale. Ventrals 161; subcaudals 58. Blackish above, each scale edged with whitish; lower parts whitish; chin and lower labials brown. Total length 240 millim.; tail 45.

The hemipenis is beset with spines proximally and papilla-like processes distally, the two areas thus characterized merging into each other. There is a large basal spine or hook. (Description based on the type, which is probably immature.)

*Distribution*.—*O. andersonii* is known only from Hongkong.

*Habits and Habitat*.—The five specimens described by Wall (1903, p. 87) "were all captured in a swamp near the Sanatorium on the Peak, whilst being drained during the campaign against malarial mosquitoes. One was dug up at a depth of about 2 feet below the surface." Mr. Herklots has kindly informed me that this Sanatorium stood at an altitude just under 1000 feet.

It would be gratifying to have additional information on the habitat preference of this snake.

*Material examined*.—I have seen only the type in the British Museum.

### 37. *Opisthotropis balteata* (Cope)

Plate VII, E, F, G and H

*Trimerodytes balteatus* Cope, 1895, Proc. Acad. Nat. Sci. Phila., XLVI, p. 426, Pl. x (type locality, Hainan).—

Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 438 (Nodoa, Hainan).

*Tropidonotus balteatus* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 607.

*Liparophis Bedoti* Peracca, 1904, Rev. Suisse Zool., XII, p. 664. (type locality, China).—Steindachner, 1906, Sitzber. Akad. Wiss. Wien (math.-natur.), CXV, Abt. I, p. 905, Pl. (Cambodia and Tongking).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 118 (Wuyung, Kwangtung).

*Opisthotropis multicinctata* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 82, figs. 5-6 (Lo-hsiang, Kwangsi).

*Description*.—Upper labials 9, occasionally 10, rarely 8; preoculars 1, rarely 2; postoculars 3, rarely 2, 4 or 5; anterior temporals 2, rarely 3; posterior temporals 2, rarely 3; scales keeled, 21-19-17; ventrals in five males 200-204, in four females 194-199; subcaudals in five males 88-99, in four females 69-85; total length of largest male 945 mm., largest female 1021; color of young whitish above. (Description based on type series of *multicinctata*.)

Fan must have taken his first scale count (21) very far forward because

the formula has been invariably determined as 19-17 by others. The formula 19-17 is undoubtedly the correct one for the species. Two *Nodoa* specimens in the American Museum have 202, 205, 38+, 85 ventrals and subcaudals, respectively (Schmidt, 1927, p. 438).

In spite of the fact that the maxillary count is given by Peracca (1904, p. 663) as 18 and by Steindachner (1906, p. 907) as 17-18, I am convinced that it really is 20-21 or over. The American Museum specimens with the latter counts are the two topotypes from *Nodoa* (Table LXIV). Fan counted 25 teeth.

The original description of the type, a male, follows:

Scales in nineteen rows, smooth, except on the tail, where all except the lateral rows are feebly keeled, and for a short distance in front of the vent, where about three dorsal rows are also weakly keeled. Each internasal longer than wide. Frontal rather wide, with straight borders, the anterior a little longer than the lateral. Parietal moderately elongate, angulate posteriorly, and embracing only the superior postocular. Loreal higher than long; oculars 1-2 or 3; temporals 1-2. Superior labials nine. These are differently distributed on opposite sides, so that the numbers may be in other specimens, eight or ten. One labial forming most of inferior border of orbit, which may be the fourth or fifth; the angle of the succeeding labial enters the orbit. On one side two plates represent the single last upper labial on the other. Inferior labials nine; pregenials shorter than postgenials, and bounded by six labials. Gastrosteges, 202; anal, 1-1; urosteges, 84. Total length, 377 mm.; tail, 80 mm.

Color black, crossed by white or pale yellow rings. These have a width of half of a scale on the middle dorsal region, and widen downward, covering two or three gastrosteges. They are frequently broken on the middle line, the halves alternating, both on the back and belly. The labials and oculars have yellow centers, and there is a yellow line from near the angle of the mouth to near the middle line above. A pair of yellow spots are on each side of the common suture of the parietal plates.

The hemipenis extends to the ninth subcaudal plate and is spinous, the proximal spines being the largest. There are three much enlarged basal spines or hooks set in a compact, longitudinal row, the distal hook larger than the other two. The lips of the sulcus are spinous and are most conspicuous proximally. (Description based on a specimen from Hainan.)

*Distribution*.—This species is known from Hainan; Wuyung in Kwangtung; Lohsiang in Kwangsi; Tongking; and Cambodia.

*Habits and Habitat*.—*O. balteata* frequents mountain streams where it may be found under rocks (Fan, 1931, p. 86). Judging by its presence at *Nodoa* and the fact that, in Yaoshan, it was taken only at Lohsiang, I conclude that *balteata* is an inhabitant of low to moderate altitudes. Field observations alone can settle this point.

I found the Hainan specimens quick and alert but quite harmless, for teasing failed to make them strike, bite, or even assume a defensive posture (Schmidt, 1927, p. 439).

Fan (1931, p. 86) states that, when held, *balteata* "will try to throw down

its tail and escape like gekkoes," certainly a remarkable procedure for a snake. According to him, it gives off an unpleasant, pungent odor when annoyed.

*Material examined*:—I have seen the following specimens: 2 from Hainan, in the American Museum; 1 from Tongking and 2 from Cambodia, in the Naturhistorisches Museum, Vienna; and 1 from Lohsiang in each of the following museums: British Museum, Museum of Comparative Zoölogy, and the U. S. National Museum.

*Remarks*:—After a scrutiny of Fan's (1931, p. 85) account of the variations of his Lohsiang series, one ceases to wonder why this species has been renamed twice and has brought forth so much discussion. (See Werner, 1926, p. 141, and 1929, p. 41.)

### 38. *Opisthotropis kuatunensis* Pope

Figure 39

*Opisthotropis kuatunensis* Pope, 1928, Amer. Mus. Novitates, No. 320, p. 5 (type locality, Chungan Hsien, Fukien); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 423, fig. 10 (type re-described and paratypes described).

*Description*:—Upper labials 14 to 16, very rarely 13; preoculars 2, rarely 3; postoculars 3, occasionally 2; anterior temporals 1, rarely 2, rarely separated from postoculars by small scales; scales heavily keeled, in 19 rows throughout; ventrals in two males 168, in thirteen females 146-154; subcaudals in one male 62, in eleven females 61-68; total length of males 523+132 and 513+121+, of three largest females 521+162, 525+153 and 505+160. Black longitudinal lines absent or very faint in adults, distinct in young. (Description based on the fifteen paratypes.)

The maximum dimensions of the female paratypes given by me in 1929 (p. 424) are in part erroneous, including as they do a male (523 mm.) and the type (516 mm.). The data given above should supplant those of 1929, l.c.

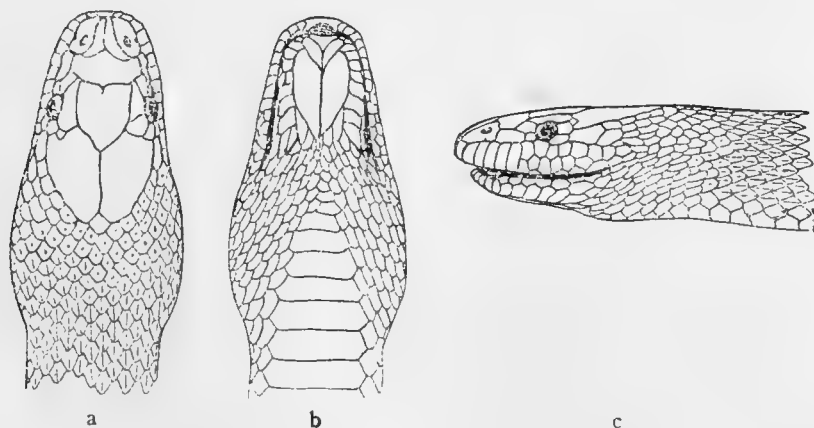


FIG. 39. *Opisthotropis kuatunensis*. Type. x 3. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head.

The scales in *kuatunensis* are rugose rather than striate as stated in the original description.

It is extremely interesting to note that, in this species, as in *O. lateralis*, the males have a somewhat lower subcaudal and a much higher ventral count.

The original description of the type specimen, a female, follows:

Maxillary teeth 25 [36], small, subequal. Head broad, depressed; nostrils near upper edge of the nasals which are not in contact. Internasals long, curved outward; prefrontal single. Frontal large, a little longer than broad, much shorter than parietals. Supraoculars divided on one side, entire on other; loreal longer than deep. Preoculars 2-2; postoculars 2-3. A total of 6 scales enter orbit on one side, 9 on other. Anterior temporals 1-1. Only first six upper labials on one side, first eight on other, extend from head shields to labial border; those following are divided horizontally, first into double, then triple, then again double rows. Their number, when only those entering margin are counted, may be given as 15-16; lower labials are even more irregular. The very finely rugose anterior chin-shields are several times the size of narrow posterior ones. Scales in 19 rows, striated and strongly keeled throughout. Ventrals 160; anal divided; subcaudals 63. The tail occupies 0.23 of total length which is 666 mm.

The uniform olive-brown of the back extends down on either side to the third row of scales and is marked only by three very obscure, black, longitudinal lines, each as wide as a scale. The belly and first three rows of scales on either side are uniformly light. The ventral surface of the tail is clouded except just behind the anus.

As indicated above, the maxillary count of the type is 36, not 25. Two paratypes, Nos. 34434 and 33708, have, respectively, 39-42 and 38-39 maxillary teeth.

In one of the two known males, the chin-shields and adjacent scales are distinctly tuberculate, while the scales of the cloacal region have knobs.

The hemipenis is spinous, very slightly forked at the tip, and extends about to the tenth subcaudal plate. The spines are set in longitudinal rows, and are more or less connected by fleshy ridges. They are recurved proximally and gradually decrease in length toward the tip of the organ. There is a moderately enlarged basal spine or hook. The lips of the undivided sulcus are conspicuously raised proximally, and spinous. (Description based on one of the paratypes.)

*Distribution*.—*O. kuatunensis* is known only from its type locality in northwestern Fukien.

*Habits and Habitat*.—This semi-aquatic snake inhabits the highest forest cascades of the mountains about Kuantun and Sanchiang in Chungan Hsien. It is secretive, hiding by day in the beds of the streams and apparently prowling by night. It does not bite or strike when handled but gives off a strong, musky odor.

Three of the paratypes contained 5, two 6 and one 3 well-developed eggs (Pope, 1929, p. 425) with embryos too small to be revealed by gross ex-

amination. Two average eggs measure  $40 \times 10$  and  $34 \times 12$  mm., and two of the gravid females were collected between June 12 and July 20, 1925. *O. kuatunensis* is certainly oviparous.

*Material examined*:—I collected the type series of sixteen specimens.

### 39. *Opisthotropis lateralis* Boulenger

Figure 40

*Opisthotropis lateralis* Boulenger, 1903, Ann. Mag. Nat. Hist., (7) XII, p. 350 (type locality, Manson Mts., Tongking, 3000-4000 feet).

*Tapinophis shini* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 321 (type locality, Yaoshan, Kwangsi).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 80, fig. 4 (Lohsiang and Kuchen, Kwangsi).

*Description*:—Upper labials 10, very rarely 9 or 11, normally 5th, 6th and 7th entering orbit; preoculars single; 1 subpreocular very rarely confluent with preocular; 2 postoculars; normally a single anterior and 2 posterior temporals; scales keeled, in 17 rows throughout; ventrals in six males 161-173, in four females 159-162; subcaudals in six males 51-54, in four females 49-56. (Description based on the ten specimens of *Tapinophis shini* from Lohsiang and Kuchen, including the type and paratype which measure 437 and 393 mm. in total length, respectively.)

When examined closely, the keels in *lateralis* will be seen to be serrate, the scales themselves finely tuberculate.

The dorsum may be almost uniform, as in the type of *lateralis*, or it may have fairly distinct but narrow longitudinal lines formed by black margins to the scales lying above the bold lateral stripes that separate the dorsal from the ventral coloration.

It is extremely interesting to note that, in this species, as in *O. kuatunensis*, the males have a distinctly higher ventral and a slightly lower subcaudal count.

The type has 27 maxillary teeth, slightly increasing in size posteriorly.

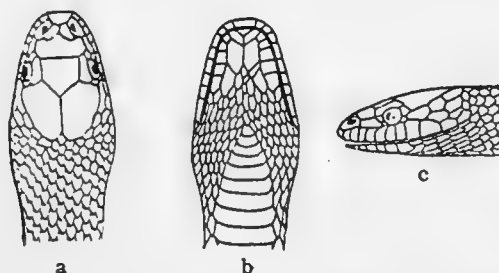


FIG. 40. *Opisthotropis lateralis*.  $\times 4$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. Specimen from Lohsiang, Kwangsi. (From Fan.)

The original description of the type, a male, follows:

Snout short, rounded, much depressed, feebly projecting beyond the mouth. Rostral a

little broader than deep, well visible from above; nostril in the upper part of an undivided nasal; internasals as long as broad; præfrontal semidivided; frontal a little longer than broad, twice as broad as the supraocular, as long as its distance from the end of the snout, shorter than the parietals; loreal longer than deep; two præ- and two postoculars; temporals 1 + 2; ten upper labials, fifth and sixth entering the eye; four or five lower labials in contact with the anterior chin-shields; posterior chin-shields nearly as long as the anterior and separated from each other by scales. Scales in 17 rows, striated and feebly keeled, with minute granular asperities; the keels stronger on the tail. Ventrals 172; anal divided; subcaudals 45 [46]. Olive-grey above, yellowish white beneath, the two colours sharply defined by a black line running along the third series of scales and extending to the eye. Total length 360 millim.; tail 55.

The hemipenis extends to the eighth subcaudal plate and is beset with spines proximally, papilla-like structures distally, the two areas thus characterized merging into each other. Proximal to the spinous area, there are two enlarged basal spines or hooks, one immediately distal to the other. (Description based on a specimen from Yaoshan.)

*Distribution*.—This species is known only from the Manson Mountains of northern Tongking, and Yaoshan in eastern Kwangsi.

*Habits and Habitat*.—Judging by the localities whence this species has come, it is an inhabitant of high, forested mountains. The discovery of a fresh-water shrimp in the stomach of a specimen from Lohsiang indicates that it is aquatic like *O. andersonii* and *O. kuatunensis*, and should be looked for in swift mountain streams.

*Material examined*.—I have seen the following material: the type of *lateralis*, in the British Museum; the type of *Tapinophis shini*, in the Berlin Museum; and 4 additional specimens of *shini*, 1 in each of the following museums: Berlin Museum, British Museum, Museum of Comparative Zoology and the U. S. National Museum.

*Remarks*.—An examination of the types of *lateralis* and *shini*, and a direct comparison in London of the former to a topotype of the latter, has convinced me that *lateralis* and *shini* are one and the same species. The type of *lateralis* has 27 maxillary teeth, while that of *shini* probably has about the same number, Mell's description notwithstanding. Unfortunately, I neglected to designate in my notes on which of the two specimens in Berlin it was that I determined the count as approximately 27. As already indicated, I am fully aware that Mell gives it for *shini* as 18, while Fan (1931, p. 80) put it as 18-20. This merely goes to show how difficult and uncertain this character is. The ventral count of *lateralis* (172) comes within the range given by Fan for male *shini* (161-173), but near the upper extreme, while the subcaudal count of *lateralis* (45 in the original description but recounted as 46 by me) falls only three or four plates below Mell's counts of *shini*. However, since in this species, males appear to



have fewer subcaudals than females, one would expect to find males from Yaoshan with fewer than 49 subcaudals or as few as the 46 of *lateralis*, the type of which is a male.

40. *Opisthotropis latouchii* (Boulenger)

Plate VIII, B, C, D, E and F

*Tapinophis latouchii* Boulenger, 1899, Proc. Zool. Soc. London, p. 164, Pl. xviii (type locality, Kuatun, Fukien).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 118 (northern Kwangtung at the Hunan-Kiangsi boundary region).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 77 (Kuliang, Fukien).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 421 (Chungan Hsien, Yenping and Futsing Hsien, all in Fukien).

*Cantonophis praefrontalis* Werner, 1909, Jahresh. Ver. Naturk. Württembg., LXV, p. 57 (type locality, Canton); 1909, Jahrb. Hamburg. Wiss. Anst., XXVI, Beih. 2, p. 218 (Foochow and Fukien).

*Description*.—Scales keeled, in 17 rows throughout; ventrals in nine males 153-163, in eight females 146-157; subcaudals in seven males 55-63, in eight females 50-59. (Description based on seventeen examples from Fukien.)

Species of *Opisthotropis* are difficult to evaluate and identify mainly because of the unusual amount of variation in arrangement and number exhibited by certain head plates. A summary of the chief variations (or lack of such) in sixty-seven specimens from the Sanchiang-Kuatun mountains (American Museum Nos. 34441-47, 34449-469, 34471-486, 33711-730, 33733-34, 33743) should serve to illustrate this point, define *latouchii* more completely, and forestall the description of supposed new species based on individual variations. It should be noted that since all the characters summarized are bilateral, the total number of counts or tabulations is just double the number of individuals studied, i.e., one count or tabulation for either side of each specimen. The summary follows:

1. The nasal is never completely divided below the nostril and partly sutured off from below in only three tabulations.
2. There is invariably one anterior temporal on each side.
3. The upper labials are 9 in eighty counts, 8 in fifty, 7 in three and 10 in but a single count.
4. The first upper labial is always vertical and never in contact with the posterior portion of the nasal. The latter plate is in contact with 3 labials in all but three counts, in which it touches only 2.
5. Two upper labials enter the eye in ninety-eight counts, 1 in the remaining thirty-six.
6. The last upper labial is greatly elongate on both sides (two tabulations) in but one specimen, on one side only in another.
7. The supraocular is never divided.
8. The loreal enters the eye in one hundred and fourteen out of one hundred and thirty-four tabulations.
9. There is no sign of a preocular in ninety-nine tabulations; a single minute one is present in eight, single small to moderate-sized ones in twenty-three, while 2 were found in but four tabulations. In only one of these four could both preoculars be described as moderate-sized.

10. A single postocular was present in only three tabulations, all the others having the normal 2.

The finely lineate pattern of the young becomes obscure with age and may disappear entirely middorsally (Pope, 1929, p. 422).

The three largest females among a series of eighty-two specimens from Fukien measured 419, 406 and 399 mm. from snout to vent, the three largest males from the same series 395, 361 and 360 mm. (Pope, 1929, l.c.). A juvenile specimen from Chungan Hsien measures 163 mm. from snout to vent, while three advanced, pigmented embryos from two sets of Chungan Hsien eggs measure 119 mm. from snout to vent. The size at hatching may therefore be estimated at 140 mm.

The maxillary count of *Tapinophis latouchii* was originally given by Boulenger (1899, p. 164) as 17 or 18, but these numbers are almost certainly too low because, as shown in Table LXIV, this species has 23-25 maxillary teeth. The specimen with 25 on both sides is really a topotype, having been collected in the Kuatun region.

In the adult male, the chin-shields and lower labials are more or less tuberculate.

The original description, based on the type, a female, follows:

Rostral broader than deep, with straight transverse upper border, just visible from above; nasals rather large, separated by a pair of narrow internasals; præfrontal twice and a half as broad as long; frontal as long as broad, as long as its distance from the end of the snout, shorter than the parietals; supraocular narrow; loreal twice as long as deep; two postoculars, lower smaller; temporals 1 + 1 or 2; nine upper labials, the first three in contact with the nasal, fifth and sixth entering the eye; four lower labials in contact with the anterior chin-shields, which are longer than the posterior; the latter separated from each other by one scale. Scales in 17 rows, the feeble keel not extending to the extremity of the scale. Ventrals 149; anal divided; subcaudals 53. Olive above, with interrupted black longitudinal lines, yellow on the sides and below; a black streak along the side of the body, along the adjacent halves of the second and third rows of scales; labials edged with blackish; lower parts uniform, except the base of the tail, which bears a black median streak. Total length 455 mm.; tail 85.

The hemipenis is spinous, slightly forked at the tip, and extends to the ninth subcaudal plate. There is a moderately enlarged basal spine or hook and several slightly enlarged spines near it. Just distal to these, the organ is beset with numerous small spines which continue to the tip, near which they become papilla-like in form. The lips of the sulcus are raised and bear spines. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—*O. latouchii* is known with certainty only from the following localities:

Kwangtung: northern Kwangtung at the Hunan-Kiangsi boundary region.

Fukien: Chungan Hsien (including Kuatun); Yenping; Kuliang; Futsing Hsien.

Kiangsi: Pingsiang.

This species is listed from Szechwan (Mell, 1931, p. 205), Hunan and Kwangsi (Gee, 1929, p. 80), but on what grounds I am unable to determine. Mell has informed me in person that his Yunnan record (1922, p. 118) is based on another animal. Werner's *Cantonophis praefrontalis*, with Canton as its type locality, was described along with a collection of specimens from all over the world, so it is not surprising that its data are only approximately correct. His 1909, p. 218, record for Foochow is scarcely to be taken literally either.

*Habits and Habitat*.—I have written an account of this snake in Fukien as follows (1929, pp. 422-423):

*T. latouchii* seemed to be rare in Futsing but this may be due to the scarcity of suitable cascades there. It was fairly common at Yenping but in the Kuatun mountains it was abundant even in the tiniest forest streams. It is a burrower in the beds of mountain springs and streams. In the day it may be found buried under loose rock, gravel and decaying vegetable matter in cold watercourses of all sizes. At night it is more easily discovered. When uncovered it at once attempts to burrow deeper and this it can do with great skill. We found that it cannot live in dry containers as the various species of *Natrix* can, for we lost several in attempting to send them only a few miles out of water. When handled it shows no signs of defensive behavior but emits a strong musky odor. It makes endless attempts to burrow or hide under something.

One specimen vomited a large earthworm and remains of such were found in the stomachs of five. In eight more the stomachs contained masses of gritty earth strongly suggestive of the same diet. The rest of the stomachs were empty.

The number of eggs ranges from 1 to 4. Thirteen [preserved] females contained 3 eggs, eight contained 2, while 4 eggs were found in only six. A single one held but 1 egg. The following field records are not included in the figures just given. On July 8 one of these snakes was brought in at Kuatun with two pale yellow eggs measuring  $37 \times 7$  mm. and  $31 \times 5$  mm., respectively. On the 12th a Kuatun collector found a *latouchii* coiled about three eggs placed under a flat stone in the bed of a cascading stream. The eggs, according to him, were only half submerged. They were white with yellowish tips and averaged 29 mm. in length. His report should be credited. On August 15 a Kuatun man brought in three white eggs containing barely pigmented *latouchii* embryos. Two of the three eggs were adherent. On the 19th two white eggs containing well-pigmented *latouchii* embryos were bought also at Kuatun. Finally, on the 28th at Kuatun four white, adherent eggs containing advanced embryos were secured. The longest was 28.5, the shortest, 25.5 mm. from tip to tip. The extreme measurements of the lesser diameter were 13.6 and 16.5 mm., respectively.

Egg-teeth are evident in three series of advanced embryos in the American Museum (Nos. 34489-91). The advanced, pigmented embryos from the August 28 lot of eggs described above measure 148, 141, 137 and 133 mm. in total length. They are No. 34491.

In extreme northern Kwangtung, *latouchii* is found only at an altitude of 600 meters or more (Mell, 1922, p. 118). This is in contrast to its presence in Futsing Hsien at only a few hundred feet above sea-level, but this difference in vertical distribution may be readily accounted for by northern Kwangtung

lying at the southern extremity of its range. Mell (1929, p. 134) confirms my observations of an earthworm diet.

*Material examined*:—I have seen the following specimens: the type, in the British Museum; 82 specimens from Fukien, in the American Museum; 2 from Pingsiang, in the Naturhistorisches Museum, Vienna; 3 from Kwangtung, in the Berlin Museum; 1 from Kwangtung, in the Museum of Comparative Zoölogy; 1 from the type locality and 1 from Kuliang, in the U. S. National Museum.

#### 41. *Opisthotropis maxwelli* Boulenger

*Opisthotropis maxwelli* Boulenger, 1914, Ann. Mag. Nat. Hist., (8) XIV, p. 483 (type locality, southern Fukien).

*Description*:—The original description of the type, a female, follows:

Snout short and broad, much depressed, not projecting. Rostral twice as broad as deep, just visible from above; internasals twice as long as broad; nasal cleft extending from the nostril to the first labial; a single præfrontal; frontal large, as broad as long, a little more than twice as broad as the supraocular, much shorter than the parietals; loreal longer than deep; two præ- and two postoculars; a very elongate anterior temporal; seven upper labials, fifth entering the eye, seventh very long; anterior chin-shields a little larger than the posterior, in contact with five lower labials. Scales in 17 rows, smooth on the nape, feebly keeled on the body, rather strongly keeled towards the tail. Ventrals 151; anal divided; subcaudals 56. Blackish above, yellow beneath. Total length 305 mm.

In the type, the first upper labial is long and extends backward to make good contact with the posterior part of the nasal.

The type has 22 or 23 maxillary teeth.

*Distribution*:—This species is known only from southern Fukien, the type locality.

*Material examined*:—I have examined the type in the British Museum. It is the only specimen that I know of.

#### Genus *Rhabdops* Boulenger

*Rhabdops* Boulenger, 1893, Cat. Snakes Brit. Mus., I, p. 300 (type, *Ablabes olivaceus*).

*R. olivaceus* of southern India is the only known species of this genus in addition to the one treated below.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Belly uniformly yellow; a single internasal and normally a single prefrontal; 10 to 12 small, subequal maxillary teeth.

#### 42. *Rhabdops bicolor* (Blyth)

*Calamaria bicolor* Blyth, 1854, Journ. Asiat. Soc. Bengal, XXIII, p. 289 (type locality, Assam).

*Ablabes bicolor* Anderson, 1879, Zool. Res. W. Yunnan, p. 809 (Muangla, Chanta valley, western Yunnan).

*Pseudocyclophis bicolor* Boulenger, 1890, Fauna Brit. India, p. 300.

*Description*.—Boulenger (1893, p. 301) describes this species as follows:

Rostral large, more than twice as broad as deep, just visible from above; nasal divided below the nostril; internasal single, as long as or a little shorter than the likewise single præfrontal; frontal as broad as long, as long as its distance from the end of the snout, two thirds the length of the parietals; supraocular very small; loreal as long as deep; one præocular; two postoculars; temporals 1 + 1; five upper labials, the upper angle of the third entering the eye, fifth very large; three lower labials in contact with the anterior chin-shields, which are not longer than the posterior. Scales in 17 rows. Ventrals 199-213; anal divided; subcaudals 58-77. Blackish brown above, brownish white inferiorly. Total length 600 mm.; tail 130.

Anderson (1879, l.c.) notes that there may be 2 preoculars and 3 postoculars and I have seen a Shillong specimen with 3 prefrontals. The ventrals may be as few as 188 or as many as 217 (Wall, 1908, p. 322, and 1925, p. 810). Wall also remarks that the lateral scales in the cloacal region are not tuberculate. He presumably refers to a male specimen. The dorsum may have a somewhat obscure but obvious, finely lineate pattern, the lines corresponding to the scale rows. The belly is generally yellow (Wall, 1925, l.c.).

Wall (1908, l.c.) gives additional data on Shillong specimens, among them the following counts: ventrals in five males 209-217, in two females 195-196; subcaudals in five males 73-79, in two females 63-71.

The hemipenis is not forked and extends to the eighth to ninth subcaudal plates. It is spinous, the numerous spines gradually decreasing in size toward the tip of the organ where they are very small. The organ also has fleshy longitudinal ridges, a pair of which border the sulcus. These ridges bear spines. The sulcus is not forked. (Description based on a specimen from the Bhamo District.)

*Distribution*.—*R. bicolor* is known only from the Khasi Hills in Assam; the Kachin Hills in Upper Burma; and the Chanta valley of western Yunnan.

*Habits and Habitat*.—Wall (1925, l.c.) states that *bicolor* is a "hill snake living at an altitude above about 4000 feet." It probably is also found at lower levels in Yunnan because parts of the Chanta valley are only 2900 feet above sea-level (Davies, 1909, p. 405).

Wall (1926, p. 561) found that one Kachin Hills specimen had eaten what appeared to be a slug, while another had devoured a spider, but *bicolor* feeds chiefly on earthworms (Wall, 1908, p. 323, and 1912, p. 686).

One specimen, when teased, refused to bite but coiled up and did not move when annoyed (Wall, 1908, l.c.).

*Material examined*.—The only specimens of this species that I have seen are from Assam and the Kachin Hills in the British Museum and from the latter region in the Museum of Comparative Zoölogy. I have not examined

the only known Chinese specimen (Indian Museum No. 4194, Muangla, Chanta valley, Yunnan).

Genus **Trirhinopholis** Boulenger

*Trirhinopholis* Boulenger, 1893, Cat. Snakes Brit. Mus., I, p. 419 (type, *T. nuchalis*).

This genus includes only two species, *nuchalis* from Burma, and the form treated below. *T. nuchalis* has been collected not far from the Yunnan boundary (Wall, 1925, p. 811, and 1926, p. 561), and Smith (1930, p. 681) has recorded it from the Fansipan Mountains of northern Tongking. However, examination of his specimen, a female with only 14 or 15 maxillary teeth, 6 upper labials, the 3rd and 4th entering the eye, 117 ventrals, 19 subcaudals and 15 rows of scales, has convinced me that it is not *nuchalis* but possibly *Plagiopholis delacouri* Angel, originally described from Tongking.

The genus *Plagiopholis* includes only two forms, the type species, *blakewayi* Boulenger (1893, p. 301), described from the Shan States, and *delacouri* Angel (1929, p. 78, type locality, Xieng Khouang). The general appearance of the former strongly suggests species of *Trirhinopholis*, and, since the characters given by Boulenger to distinguish *Trirhinopholis* from *Plagiopholis* do not seem to be of generic rank, I was strongly inclined to unite them. However, examination of the hemipenes of *nuchalis*, *styani* and *blakewayi* has convinced me that the genera may be allowed to stand. In the last named species this organ is not forked, and a prominent, spinous ridge extends along either branch of the deeply bifurcate sulcus, while in *nuchalis* and *styani* the hemipenis itself is deeply forked and devoid of spinous ridges paralleling the sulcus. Other minor differences need not be given here. I examined a Mogok *nuchalis* and a specimen of *blakewayi* from Sinlum Kaba, both in the British Museum. It would be interesting to dissect the hemipenis of *delacouri*.

OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Size small; color ashy gray, scales irregularly and incompletely margined with black, a transverse, black nuchal blotch; loreal nearly always absent; scales smooth, oblique, in 15 rows throughout; secretive and inoffensive.

43. **Trirhinopholis styani** Boulenger

Plate VIII, G, H and I

*Trirhinopholis styani* Boulenger, 1899, Proc. Zool. Soc. London, p. 164, Pl. XVIII (type locality, Kuatun, Fukien).—Thompson, 1913, Proc. Acad. Nat. Sci. Phila., LXV, p. 213 (Wangwanshan, Anhwei; anatomy).—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 29 (Mokanshan, Chekiang; Fukien); 1915, XLVI, p. xiii (Kuling, Kiangsi); 1916, XLVII, p. xv (Fukien).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 77 (Mt. Omei, Szechwan; Foochow).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 425 (Chungan Hsien, Fukien).

*Description*.—Loreal very rarely present; upper labials 6; preoculars single; postoculars 2; anterior temporals 2; posterior temporals 2, very rarely 1;

scales smooth, oblique, in 15 rows throughout; ventrals in males 114-118, in females 120-126; subcaudals in males 27-29, in females 22-29; males from snout to vent 303, 239, 197 mm., females 338, 315, 311, 285, 121, 109 mm. (Description based on nine specimens from Chungan Hsien.)

The nuchal pattern is more vivid in the young.

The counts for ten specimens from Mt. Omei are as follows: ventrals in three males 109-110, in seven females 113-118; subcaudals in three males 29-30, in seven females 16-26 (see Stejneger, 1925, p. 78). These figures compare fairly well with those for Fukien material even though the Szechwan counts are somewhat lower.

The presence or absence of a loreal presents an interesting geographical difference, for this scale is present only on one side of one among fifteen Fukien and Chekiang examples, while among thirteen from Szechwan, it is present on both sides in four, only on one side in one, and partly sutured off on both sides in one.

Thompson (1913, p. 213) records 20 maxillary teeth for the Wangwanshan male while I count 21 in American Museum No. 34628.

In the adult male, the scales of the cloacal region are distinctly ridged and ridges can even be seen in this region on half-grown individuals of this sex.

The original description, based on the two cotypes, one a male, the other a female, follows:

Snout short, slightly prominent. Rostral rather large, once and two thirds as broad as deep, the portion visible from above about half as long as its distance from the frontal; internasals twice as broad as long, much shorter than the præfrontals; frontal hexagonal, once and one third or once and a half as long as broad, longer than its distance from the end of the snout, a little shorter than the parietals; no loreal, posterior nasal forming a suture with the single præocular; two postoculars; temporals  $2 + 2$ ; six or seven upper labials, third and fourth entering the eye; anterior chin-shields longer than the posterior, in contact with the symphysial and three lower labials. Scales in 15 rows. Ventrals 112-121; anal entire; subcaudals 22-28. Brown above, with very small black spots; a black nuchal blotch or cross-band edged with yellowish; labials yellowish, with blackish edges; rostral yellowish, with a large blackish spot; ventrals and subcaudals yellowish, dotted and speckled with blackish on the sides. Total length 350 millim.; tail 45.

The hemipenis extends to the eighth subcaudal plate and is forked opposite the fifth. Proximal to the point of forking, the organ is smooth but about opposite to this point it becomes spinous, the spines extending approximately half-way to the tip from their point of origin. The first spine at the base of each fork is very large and immediately proximal to the rest, which are smaller and nearly uniform in size. The line of demarcation between the spines and the calyces which supplant them is abrupt but not straight across the organ. The calyces have scalloped edges and are well developed throughout, but especially so adjacent to the sulcus near the tip of the organ. The sulcus is conspicuous

only proximal to the point of forking where its lips are raised. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—*T. styani* is known from Chungan Hsien in Fukien; Mokuanshan in Chekiang; Wangwanshan in Anhwei; Kuling in Kiangsi; and Mt. Omei in Szechwan.

Sowerby secured it at Foochow (Stejneger, 1925, p. 78), but this record of a mountain snake at Foochow requires confirmation (compare similar remark under *Achalinus spinalis*).

*Habits and Habitat*.—In Fukien, I found *T. styani* only in the high forests and bamboo groves in the region of the type locality. Elsewhere, it has been secured with certainty only in mountains of considerable size. The altitude of Hsinkaiszu on Mt. Omei, where Graham collected several specimens (Stejneger, 1925, l.c.), is 4500 feet, so we have some clue to the vertical distribution of *styani* in Szechwan.

This snake is active and uses its head like a burrower. When teased, it neither strikes, bites, nor assumes a defensive position. One specimen, when annoyed, flattened its body. (Pope, 1929, p. 426.)

The stomachs of three Chungan Hsien specimens contained a lot of gritty dirt suggestive of an earthworm diet (Pope, 1929, l.c.), while two of the Mt. Omei examples examined by me had eaten an earthworm apiece.

A Chungan Hsien female contained 7 eggs, one of which measured 15.5 x 5.5 mm. (Pope, 1929, l.c.). I have since found 5, 6 and 11 eggs, respectively, in three Mt. Omei females. One of the eggs in the clutch of 5 measured 19 x 11 mm. and contained a very small embryo, while the female with 11 eggs was collected in July. This species is certainly oviparous.

*Material examined*.—I have seen the following material: the 2 cotypes and a topotype, in the British Museum; 9 specimens from Chungan Hsien, in the American Museum; 12 from Szechwan and 1 from Kuatun, in the U. S. National Museum; and 1 from Mt. Omei, in the Museum of Comparative Zoölogy.

#### Genus *Achalinus* Peters

*Achalinus* Peters, 1869, Monatsber. Akad. Wiss. Berlin, p. 436 (type, *A. spinalis*).

*Ophielaps* Sauvage, 1877, Bull. Soc. Philom. Paris, (7) 1, p. 108 (type, *O. braconieri*).

In addition to the species treated below, this small genus includes only three valid forms, namely, *A. niger* Maki (1931, p. 60) and *A. formosanus* Boulenger (1908, p. 222), both of Formosa, and *A. loochooensis* Thompson, of Amamioshima.

I am convinced that *Achalinopsis sauteri* Steindachner (1913, p. 326), described from Formosa, is an unconditional synonym of *Achalinus formosanus* because these two alleged species are strikingly alike and differ only in the



possession of a loreal by the latter. I have determined the number of maxillary teeth in the type of *formosanus* as 18 (possibly one more or less), and although the maxillary count for *sauteri* is given as 15 by Steindachner in the original description, examination of his excellent plate illustrating the skull shows that his number is a little low. The whole matter is cleared up by the simple assumption that the type of *formosanus* is anomalous in the possession of a loreal. The fact that Maki (1931, p. 61) reported no additional material of *formosanus* strongly supports this assumption. I have seen the cotypes of *sauteri* as well as the unique type of *formosanus*.

In this connection it is well to record that *Fimbrios klossi* Smith (1921, p. 425), described from southern Annam, should be placed near *Achalinus* in the Colubridæ, not next to *Xenodermus* in the Acrochordidæ, as stated by Smith. Although *Fimbrios* is unquestionably a valid genus, the striking resemblance of *klossi* to forms of *Achalinus* has forced me to conclude that its true relationships have not been properly determined. Among other points, the raised labial edges very strongly suggest *Achalinus* species. I have examined the type series of *klossi*.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Size small; color uniform brown or slate gray above, with or without a dark middorsal stripe; scales keeled, iridescent; subcaudals and anal entire; secretive, inoffensive.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Suture between internasals longer than that between prefrontals; 23-25 rows of scales at midbody. . . . . *rufescens*, p. 181
- II. Suture between internasals shorter than that between prefrontals; 21-23 rows of scales at midbody. . . . . *spinalis*, p. 183

#### 44. *Achalinus rufescens* Boulenger

##### Figure 41

*Achalinus rufescens* Boulenger, 1888, Ann. Mag. Nat. Hist., (6) II, p. 43 (type locality, Hongkong); 1893, Cat. Snakes Brit. Mus., I, p. 308, Pl. xx; 1896, III, p. 612 (Hongkong, 1700 feet).—Wall, 1903, Proc. Zool. Soc. London, p. 88 (Hongkong).—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 29 (Fukien).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 118 (between Linping and Chungsun, Kwangtung).

*Achalinus meridianus* Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 200 (type locality, Namkao, Hainan, 300 meters).

*Stoliczkaia kwangsiensis* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 44, fig. 1 (type locality, Lohsiang, Kwangsi).

*Description*.—The original description, based on the type, a male, follows:

Head narrow, elongate. Suture between the internasals twice as long as that between the præfrontals; frontal broader than long, half as long as the parietals; only the upper anterior temporal in contact with the eye; three shields bordering the parietals on each side, the third very large and separated from its fellow by a small azygos occipital; five upper labials, third and fourth entering the eye, fifth much elongate; five lower labials, third much elongate, first in contact with its fellow behind the mental; three pairs of large chin-shields,

succeeded by the ventrals, first and second longer than broad, third as long as broad. Scales strongly keeled, some distinctly tricarinate, in twenty-five longitudinal series; on the anterior half of the body each ventral scute is in contact with the second series of scales. Ventrals 136; anal single; subcaudals 82. Uniform pale reddish brown above; upper labials and a spot on the temple yellow; uniform yellowish beneath. Total length 290 millim.; tail 80.

Due to its small size, the first upper labial is readily overlooked. Boulenger's count of 5 above should be 6 (Boulenger, 1893, p. 308). It is, then, the 4th and 5th that enter the eye.

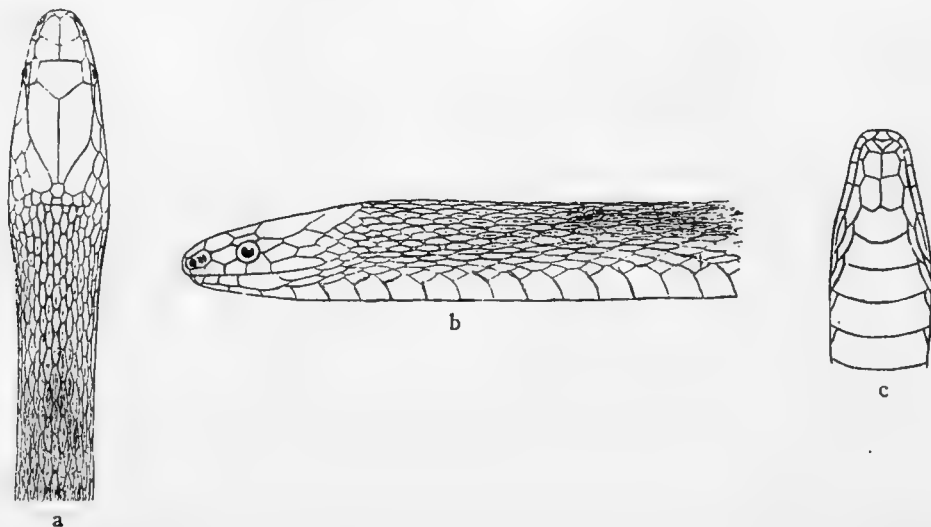


FIG. 41. *Acalinus rufescens*. Type.  $\times 3$ . a. Dorsal view of head and neck. b. Lateral view of head and neck (first upper labial not shown). c. Ventral view of head. (From Boulenger.)

The scale rows are either constant in number throughout the length of the body or reduced by not more than two rows from the number at midbody.

In Wall's (1903, p. 88) four topotypes the ventrals are 150-158, the subcaudals 56-61, and the scales in 23 to 25 rows at midbody. These counts probably represent females. Boulenger's (1896, p. 612) topotype, a male, has 137 and 76 ventrals and subcaudals, respectively, while Mell's (1922, p. 118) specimen from Kwangtung, also a male, has almost the same counts, i.e. 136 and 75.

Both anterior temporals reach the eye on both sides in two of the five recorded topotypes.

*Distribution*.—*A. rufescens* is known only from Hainan (Namkao); Hongkong; Kwangtung (between Linping and Chungsun); Fukien; and Kwangsi (Lohsiang).

In recording *rufescens* from Fukien, Stanley (1914, p. 29) gives no description, so confirmation of its presence in that province would be most welcome though not surprising.

*Habits and Habitat*.—Wall (1903, l.c.) found his specimens on the Hongkong Peak; Boulenger's (1896, l.c.) topotype was taken on Hongkong at 1700 feet; Mell's (1922, pp. 5 and 118) and Fan's (1931, pp. 2 and 44) examples were found in mountains; and Smith's (1923, pp. 197 and 200) in mountains at 300 meters, so it may safely be concluded that *rufescens* frequents mountainous country.

Descriptions of the exact sites at which specimens have been collected follow:

Wall (1903, l.c.): "low vegetation on the slopes of the Peak."

Mell (1922, l.c.): cleared land in a wooded region.

Smith (1923, p. 197): "open mountainous country, interspaced with wooded ravines."

*Material examined*.—I have seen the type and topotype from Hongkong, and the type of *meridianus*, in the British Museum; and a specimen from Kwangtung, in the Berlin Museum.

*Remarks*.—I think there is no question about the identity of *meridianus* with *rufescens*. However, it might be remarked that the topotype of *rufescens* in the British Museum has 29 maxillary teeth, or the same number as the type of *meridianus*.

The question of the identity of Fan's *Stoliczkaia kwangsiensis* is complicated by his obvious confusion of the ventral and subcaudal counts of his type and paratype. He states that the paratype, a male, has the longer tail and yet he gives a lower subcaudal count (56) for it than for his type (67), a female. His type, properly enough, has the higher ventral count (148). It is impossible to say just where his error was made. Fan's maxillary tooth count is low, but teeth are readily overlooked in such a small snake. He probably overlooked the minute first upper labial just as Boulenger once did, a fact noted above.

#### 45. *Achalinus spinalis* Peters

##### Figure 42

*Achalinus spinalis* Peters, 1869, Monatsber. Akad. Wiss. Berlin, p. 436, Pl. (type locality uncertain, possibly Japan).—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 29 (Taichow, Chekiang); 1915, XLVI, p. xiii (Kuling, Kiangsi).—Chang and Fang, 1931, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VII, p. 264, fig. 8 (Nanking).

*Ophielaps Braconneri* Sauvage, 1877, Bull. Soc. Philom. Paris, (7) I, p. 109 (type locality, eastern Kiangsi).

*Achalinus rufescens* Guenther, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 220 (Ichang, Hupeh) (not of Boulenger, 1888).

*Achalinus braconneri* Boulenger, 1893, Cat. Snakes Brit. Mus., I, p. 309; 1896, III, p. 613 (mainland opposite Chusan Is.).

*Achalinus spinalis* ssp. n. ? Mell, 1931, Lingnan Sci. Journ., VIII, p. 206 (southern Hupeh).

*Achalinus spinalis weigoldi* Mell, 1931, l.c. (type locality, Washan, Szechwan).

*Description*.—Upper labials 6, pre- and postoculars absent, loreal entering orbit; anterior temporals normally 2; posterior temporals 2; scales keeled, in 23, rarely 21, rows on neck and at midbody, 23 or 21, rarely 22, before vent;

ventrals in six males 146-155, in nine females 160-166; subcaudals in six males 50-56, in nine females 39-46; three largest males 272, 237, 217, females 345, 335, 320 mm. from snout to vent. (Description based on fifteen specimens from Chungan Hsien.)

The ventral and subcaudal counts are rather erratic in this species, as shown by the data given above and in Table XIX.

TABLE XIX. VENTRAL AND SUBCAUDAL COUNTS OF *ACHALINUS SPINALIS* FROM KIANGSU, CHEKIANG AND SZECHWAN

Locality	Sex	Ventrals	Subcaudals	Museum or Reference
Nanking.....	probably ♀	177	42	Chang and Fang, 1931, p. 264
Chekiang.....	probably ♀	180	48	Boulenger, 1896, p. 613
Ichang.....	♀	170	48	Boulenger, 1893, p. 309
Ichang.....	3 ♂	159-163	57-59	Boulenger, 1893, p. 309
Süchow.....	2 ♀	153-157	47-48	U. S. Nat. Mus. Nos. 71576-77
Süchow.....	♂	145	59	U. S. Nat. Mus. No. 71578
Mt. Omei.....	♀	175	54	U. S. Nat. Mus. No. 80092
Chouchiakou.....	♀	158	49	U. S. Nat. Mus. No. 81513
Washan.....	?	160-167	63-67	Mell, 1931, p. 206

It is impossible to correlate such varied counts with geographical or altitudinal distribution but only with local populations that cannot be considered good subspecies. This is often the case with small, secretive mountain snakes.

A translation of the original description, based on the type specimen, follows:

Rostral triangularly pointed, not projecting above. Internasals triangularly pointed, longer than broad. Nostril situated in the anterior nasal, behind this an arch-shaped depression in the posterior nasal, which lies above the second and third supralabials and makes contact posteriorly with the large freno-preorbital, twice as long as high. The prefrontals are not longer than the internasals, but twice as large, and as broad as long. The frontal is broader than long, pentagonal, the posterior angle blunt, with its shortest sides placed between the supraorbitals. The parietals are very long, pointed posteriorly, longer than all the other head shields combined. Six supralabials, the first very small, the last longer than all the others taken together, the 4th and 5th bordering the eye. No separate postorbitals; temporals long, 2 + 2 + 3. Mentals broad and very short, separated from the submentals by the first pair of infralabials. Six narrow infralabials, four of which are in contact with the submentals; 3 pairs of short submentals, of which the first pair together form a heart-shaped figure pointed

in the rear. Scales of the body lanceolate, distinctly keeled and without apical pits, forming 21 longitudinal rows. Ventrals 149, a simple anal and 62 subcaudal scutes.

Brown with a middorsal black line to the end of the tail; belly brownish yellow, the nuchal shields blackish in the middle and a median longitudinal black band under the tail. Total length 360 mm., head length 90 mm., tail 115 mm., thickness of body 7 mm.

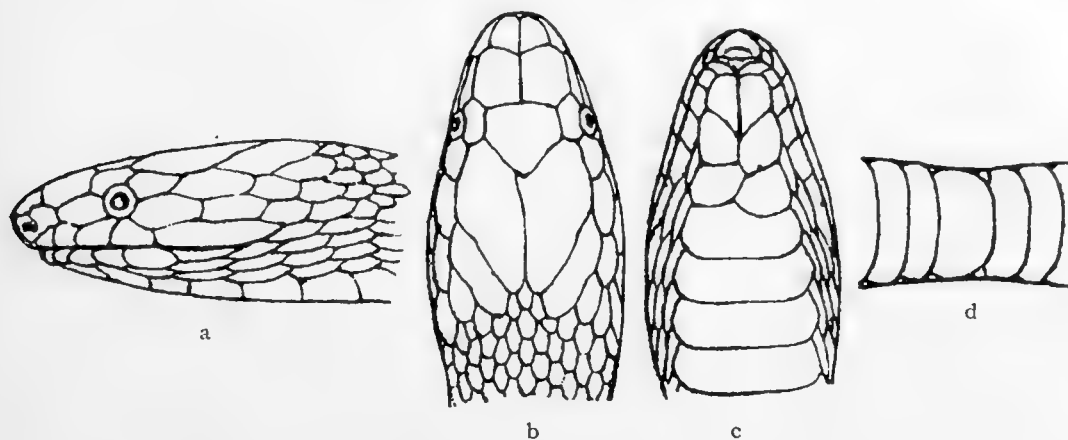


FIG. 42. *Achalinus spinalis*. Type.  $\times 4$ . a. Lateral view of head. b. Dorsal view of head. c. Ventral view of head. d. Ventral view of cloacal region. (After Peters.)

The hemipenis is excessively long and slender, extending to the sixteenth to seventeenth subcaudal plates, but it is forked opposite the sixth. Apparently spines are entirely lacking.

Due to the small size of this species and the slenderness of the hemipenes, I was unsuccessful in determining many details of structure. A Chungan Hsien specimen was studied.

*Distribution*.—*A. spinalis* is known from the following localities in China:

Chekiang: mainland opposite Chusan Is.; Taichow.

Fukien: Chungan Hsien.

Kiangsi: eastern Kiangsi; Kuling.

Kiangsu: Nanking.

Hupei: Ichang.

Szechwan: Süchow; Mt. Omei; Chouchiakou; Washan.

Stejneger (1925, p. 79) records a specimen secured by Sowerby at Foochow. I have not listed this locality above because I believe it requires confirmation (compare similar remark under *Trirhinopholis styani*). Vogt (1924, p. 339) has listed material without giving a specific locality. It is undoubtedly the basis of Mell's new subspecies, *weigoldi* (Washan).

This species also occurs in Japan, but not on Formosa, where it is apparently represented by *A. niger* Maki.

*Habits and Habitat*.—This snake has been taken at 6000 feet on Mt. Omei

and I found it common in the highest mountains about Kuatun and Sanchiang (Pope, 1929, p. 436). It also occurs at very low altitudes in the Yangtze Valley, however (Chang and Fang, 1931, p. 264).

The Nanking specimen described by Chang and Fang (1931, p. 266) was taken "from inside a ruined brick wall."

I described *spinalis* as follows (1929, l.c.):

It is extremely delicate and dies more readily than almost any other snake. Soon after death it dries and hardens in a most unusual way. This drying up might lead one to conclude that it is a secretive burrower but the greatly reduced rostral is anything but a characteristic of burrowing species. It shows not the slightest signs of defensive behavior when handled.

A Chungan Hsien female holds 7 well-developed eggs (Pope, 1929, l.c.), with very small embryos. One egg measures 19 x 7 mm., the parent 371 mm. in total length. U. S. National Museum No. 81513, collected during April or May, contains 4 eggs obviously on the point of extrusion. This indicates early egg-laying in southern Szechwan.

U. S. National Museum No. 81513 is further interesting because its stomach contains earthworm remains.

*Material examined*.—I have seen 15 specimens from Chungan Hsien, in the American Museum; 3 from Hupeh and 1 from Chekiang, in the British Museum; and 1 from Fukien and 5 from Szechwan, in the U. S. National Museum.

*Remarks*.—Stejneger (1907, p. 294) records the presence of a small, semi-lunar postocular shield in two specimens from Japan.

#### Genus *Lycodon* Boie

*Lycodon* Boie, 1826, in Férussac's Bull. Sci. Nat., IX, p. 238 (type, *Coluber aulicus*).

The rather numerous species of this genus are widely distributed over southern Asia and through the Malay Archipelago.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Color black or blackish brown with white cross-bands evident at least anteriorly; scales in 17 rows at midbody, vertebral row not enlarged.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Preocular absent, prefrontal entering eye..... *subcinctus*, p. 196
- II. Preocular present, prefrontal excluded from eye
  - A. Loreal in contact with internasals..... *a. aulicus*, p. 187
  - B. Loreal not in contact with internasals
    - 1. Loreal nearly always entering eye; preocular usually in contact with frontal; body and tail completely encircled throughout by alternate black and white bands..... *fasciatus*, p. 188

2. Loreal seldom entering eye; preocular never in contact with frontal; black bands of body nearly always interrupted on ventrals which are largely white (interruption of black bands more complete anteriorly than posteriorly and more evident in adults than in juveniles)..... *ruhstrati*, p. 191

46. *Lycodon aulicus aulicus* (Linnaeus)

*Coluber aulicus* Linnaeus, 1758, Syst. Nat., ed. 10, p. 220 (type locality, "America").

*Lycodon aulicus* Steindachner, 1869, Reise Novara, Rept., p. 74 (Amoy).—Anderson, 1879, Zool. Res. W. Yunnan, p. 826 (Pangsi, Yunnan; Bhamo, Burma).—Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 84 (Hongkong).

*Description*.—Upper labials 9, 3rd, 4th and 5th entering orbit; loreal not entering eye but in contact with internasal; preoculars single; postoculars 2, rarely 1 or 3; anterior temporals 2 or 3, rarely 1; posterior temporals 3; scales smooth, 17-15. Color, brown above, variously marked with yellow cross-bands or fine reticulations; light below. (Composite description.)

A Hongkong specimen recently collected by Herklots and now in the British Museum is a female with 192 ventrals and 56+ subcaudals, while Anderson's (1879, p. 827) Pangsi example is recorded as having 200 ventrals and 59 subcaudals.

Wall (1921, p. 159) gives the total length of the largest male and female measured by him as 692 and 737 mm., respectively.

Cope (1895, Pl. xxiv, fig. 1) figured the hemipenis of a specimen from India.

*Distribution*.—The example of this species recently collected on Hongkong by Herklots and sent to the British Museum seems to prove beyond question that it occurs on that island and removes all reason to doubt Steindachner's (1869, p. 74) Amoy record. Nevertheless, it would be most gratifying to receive a second example from the mainland of southeastern China. Anderson long ago (1879, l. c.) secured, at Pangsi in extreme western Yunnan, the only specimen ever taken in western China. However, in spite of the apparent scarcity of *aulicus* in Yunnan, numerous records for the Bhamo and Myitkyina Districts of Upper Burma (Anderson, 1879, l.c.; Boulenger, 1888, p. 601; and Wall, 1925, p. 811, and 1926, p. 561) suggest that it cannot be rare in parts of Yunnan. Gyldenstolpe (1916, p. 12) records it from Chiangmai, northern Siam.

Widely distributed from Ceylon northward through Peninsular India, to Burma and southern China; thence southward through the peninsula of southeastern Asia and the Malay Archipelago to the Philippines. Mertens (1930, p. 293) designates the form from Java and the Lesser Sunda Islands as *L. aulicus capucinus* Boie.

*Habits and Habitat*.—Wall (1909, pp. 87-101, and 1921, pp. 151-162) has

given an excellent general account of *aulicus* in India, from which I have extracted the following points of special interest:

1. It is frequently found about human habitations and even in large cities, where it may be discovered in almost any convenient crevice (pp. 152-153).
2. It is active and bites viciously when annoyed but will become tame with time (pp. 153-154).
3. It is decidedly nocturnal (p. 154).
4. Its food consists chiefly of geckos and skinks, but it also eats mice and even frogs. In turn, *aulicus* is eaten by *Bungarus caeruleus*, the common krait (p. 156).
5. It is oviparous and deposits 3 to 11 eggs from February to July. The eggs of one clutch measured 25-32 x 9-12 mm. (pp. 157-158).
6. Hatchlings vary in length from 171 to 197 mm. (p. 158).

The breeding season in central Burma probably does not coincide with that of India generally, for Wall (1925, p. 811) reports two gravid females collected at Mandalay between August and October. Each of these specimens held 3 eggs.

Smith (1914, p. 16) emphasizes the arboreal tendencies of *aulicus* in Bangkok, stating that "it is a good climber and appears to prefer the roof to the floor," while Mertens (1930, p. 295) writes of it as essentially an inhabitant of low altitudes.

*Material examined*:—I have seen the specimen from Hongkong in the British Museum collected by Herklots, but none actually from China.

#### 47. *Lycodon fasciatus* (Anderson)

##### Plate VIII, A

*Ophites fasciatus* Anderson, 1879, Zool. Res. W. Yunnan, p. 827, Pl. LXXVIII (type locality, Pangsi, Yunnan).

*Lycodon fasciatus* Boulenger, 1890, Fauna Brit. India, p. 295.

*Dinodon yunnanensis* Werner, 1922, Anz. Akad. Wiss. Wien, LIX, p. 221 (type locality, Yunnanfu); 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 46 (amplified description of type).

*Lycodon gammiei* Werner, 1929, Zool. Jahrb., Syst., LVII, p. 58 (part: *Dinodon yunnanensis*).

*Description*:—I have accumulated data on fourteen Chinese specimens of *fasciatus*, thirteen from western and northern Yunnan and one from southern Szechwan. The color pattern is remarkably uniform in all of these, the light bands covering the length of only 1 to 2 scales middorsally but with a tendency to widen noticeably ventrally. Table XX records, then, the available data on all the Chinese material known.

The maxillary count in American Museum No. 35209 is 7 + 2 + 2 on both sides. In No. 12799, it is 7 + 2 + 2 on the right, 7 + 2 + ? on the left side which is somewhat damaged. The teeth of the largest and anterior group increase in size from front to rear; those of the next or middle group are subequal in size and about as large as the third and fourth of the anterior group, while the posterior pair are subequal in size and approximately as long as the sixth tooth of the largest group.



TABLE XX. DESCRIPTION OF *LYCODON FASCIATUS* FROM YUNNAN AND SZECHWAN

Locality	Sex	Upper Labials	Upper Labials Entering Orbit	Lores Entering Orbit	Preocular to Frontal	Postoculars	Anterior Temporals	Posterior Temporals	Scales	Ventrals	Subcaudals	Light Dorsal Cross-bands	Total Length in Millimeters	Museum or Reference
Pangsi.....		8	3-5	yes		2	2	3	17-?	213	90	55	533+110	type
Tali.....	♂	8	3-5	yes					17-15	200	72(+?)	36+10		Berlin Museum (Mell Collection)
Tali.....	♀			yes						195	72	29+9		Berlin Museum (Mell Collection)
Tali.....	♀			yes					19-17	202	82	37+15		Berlin Museum No. 27701 (Mell Collec- tion)
Luchuan.....	♂	8-9	3-5	yes	yes	2	2		17-15	196	81	24+12		Mus. Comp. Zool. No. 16736
Yunnanfu....	♀	8	3-5	yes	yes		2	2	17-?	193	66	23+7	410+90	type of <i>Dinodon yun- nanensis</i>
Yunnanfu....	♂			yes	yes					189	79	23+11	about 440	Naturhistorisches Museum, Vienna
Yunnanfu....	♂	8	3-5	yes	yes no	2	2	2-3	17-15	195	70	25+9	148+33	American Museum No. 12799 (Schmidt, 1927, p. 523)
Yunnanfu....	♂	8	4-5	yes	yes	2	2		17-15	191	76	27+12	405+108	American Museum No. 35209 (Pope, 1929, p. 426)
Yunnanfu....	♀			yes						186	84	21+10		British Museum
Yunnanfu....	♂	8	3-5	yes	no	2	2		17-15	202	80	32+11		Mus. Comp. Zool. No. 18965
Tungchwan...	♀			no						201	68	31+10		British Museum
Tungchwan...	♂			yes	no					194	75	25+12	about 460	Naturhistorisches Museum, Vienna
Ningyuan.....	♂	8		yes no	no	2	2		17-15	207	75	40+14		U. S. Nat. Mus. No. 76250

As in *L. ruhstrati*, the anterior head shields of this species are minutely tuberculate, but I have not determined whether these tubercles are correlated with sex in *fasciatus* or not.

Wall (1911, p. 951) found no sexual difference in ventral and subcaudal counts and the data tabulated above certainly confirm this conclusion.

The original description, based on the type specimen, follows:

Head flat and rather spatulate, distinct from the neck. Anterior frontals rather broader than long; posterior frontals much more so; vertical of moderate size nearly as broad as long; occipitals narrow and elongate; nostril between two nasals, the anterior frontal and the first labial. The loreal long and tapering to a point posteriorly and entering the orbit. One preocular reaching to the upper surface of the head. Two postoculars. Temporals  $2 + 3 + 2$ ; two in contact with the postoculars. Eight upper labials, the third, fourth and fifth entering the orbit. The posterior chin-shields narrow and much longer than the anterior shields, which are in contact with five labials. The second and third teeth are elongated, followed, after a considerable interval, by two small teeth, the most posterior being the longer. These are succeeded by two much longer, almost fang-like teeth. The palatine teeth are numerous and sub-equal in size. The mandible has an anterior fang. Seventeen rows of feebly keeled scales, the keels becoming more pronounced posteriorly. Ventrals 213. Subcaudals 90. The anal entire. Total length 21 inches; tail 4.34.

Body encircled by fifty-five broad purplish-black bands separated by reddish intervals about half their breadth. Upper surface of the head dark-brown. Upper labials yellowish with dusky sutures. The first black band does not encircle the neck.

The hemipenis extends to the tenth subcaudal plate. It is spinous, the relatively large, laterally compressed, proximal spines gradually merging into the smaller, much more numerous cylindrical ones of the mesial region. These retain their form and size to the end of the organ but tend to become arranged distally in transverse rows with their lateral bases connected. The sulcus is inconspicuous but its lips are slightly raised and strongly spinous throughout. (Description based on a specimen from Yunnanfu.)

*Distribution*.—In China, *Lycodon fasciatus* is known only from Pangsi, Tali, Luchuan, Yunnanfu, and Tungchwan, all in Yunnan, and Ningyuan in Szechwan. Its range extends westward from Yunnan as far as the Darjeeling District in the north, the Chin Hills, farther south, and the Southern Shan Hills, in the southwest.

*Habits and Habitat*.—Wall (1925, p. 812) describes this species in Burma as "a hill snake occurring at an altitude above 3000 feet." Its presence on the Yunnan plateau and in southern Szechwan, where the Ningyuan specimen in the U. S. National Museum (No. 76250) was collected at 6000 feet, confirms this statement in part, but probably, when living on such a high plateau, *fasciatus* is not always strictly confined to a mountain habitat. The numerous Yunnanfu records confirm this supposition. It is nocturnal (Wall, 1911, p. 950, and 1926, p. 562), climbs well (Wall, 1908, p. 324, and 1926, l.c.),

and is quick to assume a defensive attitude when annoyed (Wall, 1911, p. 950).

American Museum No. 35209 contains remains of a gecko, while I dissected a skink from the stomach of a Yunnanfu specimen in the Naturhistorisches Museum, Vienna. Wall has reported the following results of food investigations: Two specimens contained food, one a skink (*Lygosoma indica*) and the other also a skink, probably of the same species (1908, l.c.); one example had eaten a skink, while another contained lizard (skink?) remains (1925, p. 812); one specimen had fed on a skink (1926, l.c.).

Wall (1911, p. 951) states that specimens kept by Mr. Hampton ate lizards (*Lygosoma indica* and *Ophisaurus gracilis*) and snakes (*Typhlops diardi* and *Elaphe porphyracea*).

*L. fasciatus* falls prey to cobras, both *Naja naja* and *Naja hannah* (Wall, 1911, l.c.).

*Lycodon fasciatus* is oviparous and produces from 4 to 14 eggs (Wall, 1911, l.c., and 1926, l.c.). A gravid female was killed in the Kachin Hills before June 6, another between June 6 and August 12 (Wall, 1926, l.c.). Wall (1911, p. 952) records a 216 mm. individual, presumably a hatchling, collected at Shillong, September 19.

Much additional information about this snake may be found in Wall's excellent popular account (1911, pp. 948-953).

*Material examined*.—I have seen all of the 14 Chinese specimens listed in the table except the type from Pangsi.

#### 48. *Lycodon ruhstrati* (Fischer)

Figures 43 and 44

*Ophites Ruhstrati* Fischer, 1886, Abh. Naturw. Ver. Hamburg., IX, Heft 1, Nr. 6, p. 16, Pl. 11 (type locality, South Formosa).

*Ophites septentrionalis* Guenther, 1888, Ann. Mag. Nat. Hist., (6) I, p. 171 (Lushan, Kiangsi) (not of Guenther, 1875).

*Dinodon septentrionalis* Boulenger, 1893, Cat. Snakes Brit. Mus., I, p. 363 (part: Lushan, Kiangsi).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 119 (Lungtong, Kwangtung) (not of Guenther, 1875).

*Dinodon septentrionale ruhstrati* Stejneger, 1907, Herpet. Japan, p. 370 (Formosa).

*Dinodon septentrionalis ruhstrati* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 139.

*Dinodon futsingensis* Pope, 1928, Amer. Mus. Novitates, No. 320, p. 4 (type locality, Futsing Hsien, Fukien); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 427, fig. 11 (amplified description of type and paratype).

*Dinodon (septentrionale?) futsingense* Mell, 1929, Lingnan Sci. Journ., VIII, p. 207 (northern Fukien and northern Kwangtung).

*Dinodon ruhstrati* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 428 (Chungan Hsien, Fukien).

*Description*.—Crucial data on the nine Chinese specimens known to me are set forth in Table XXI.

TABLE XXI. DESCRIPTION OF *LYCODON RUHSTRATI* FROM KIANGSI, FUKIEN AND SZECHWAN

Locality	Sex	Upper Labials	Upper Labials Entering Orbit	Loreal Entering Orbit	Preocular to Frontal	Postoculars	Anterior Temporals	Posterior Temporals	Scales	Ventrals	Subcaudals	Light Dorsal Cross-bands	Total Length in Millimeters	Museum or Reference
Lushan.....				no						211	88			Boulenger, 1896, p. 363
Lungtou.....	♂	8	3-5	no					17	218	97	33+16	320+88	Mell, 1922, p. 119
Futsing Hsien...	♀	9-8	4-6 3-5	no	no	2-2	2-2	2-3	17-15	197	79	22+12	180+47	type of <i>futsingensis</i>
Futsing Hsien...	♀	8	3-5	no	no	2-2	2-2	3-3	17-15	204	77	25+12	180+47	paratype of <i>futsingensis</i>
Chungan Hsien..	♀	8	3-5	no	no	2-2	2-2	3-3	17-15	221	92	35+14	637+180	American Museum No. 34584
Chungan Hsien..	♀	8	3-5	yes	no	2-2	1-1	2-2	17-15	227	94	36+17	525+147	American Museum No. 34585
Chungan Hsien..	♂	8	3-5	no	no	2-2	2-2	3-3	17-15	223	92	33+15	571+158	American Museum No. 34586
Mt. Omei.....	♂	8	3-5	no	no	2-2	2-2	3-3	17-15	220		33+15	juvenile	U. S. Nat. Mus. No. 80939
Huangchiakou...	♂	8	3-5	no	no	2-2	2-2	3-3	17-15	219	90	35+14	juvenile	U. S. Nat. Mus. No. 73842

The head and anterior neck from about the region of the eyes to a line a few scale lengths behind the parietals are white in young specimens, while at least some indication of this white is evident even in mature specimens. The black of the dorsum is usually absent or only poorly represented on the ventrum anterior to the vent, this region being for the most part white. On the back, the black predominates anteriorly, but posteriorly either black or white may do so. The white bands invariably widen on the sides anterior to midbody. It would be very difficult to give an accurate color description of this species because the variation in pattern, especially posteriorly, is astounding. In this respect, *ruhstrati* is unlike *fasciatus* whose pattern is relatively stable.

I examined twenty-three Formosan examples in the Naturhistorisches Museum, Vienna, and determined that in none of them does the loreal reach the eye or the preocular make contact with the frontal. The black seemed more

prone to encircle the body in juvenile Formosan individuals of this series than in Chinese specimens.

Anterior to the eyes, the head shields of *ruhstrati*, both above and below, are tuberculate. The tubercles are minute, most numerous on the shields nearest the tip of the snout, and equally evident in both sexes.

The maxillary counts of the five specimens in the American Museum (Nos. 34105-06 and 34584-86) are uniformly  $7+3+2$  on both sides of each, the teeth of the largest and anterior group very rapidly increasing in size from front to rear; those of the next or middle group are subequal in size and much smaller than the two posterior ones of the largest group, while the two remaining teeth, also subequal in size, are about as long as the sixth tooth of the anterior group. My (1929, p. 427) former description of the teeth of No. 34106, type of *futsingensis*, is very inaccurate.

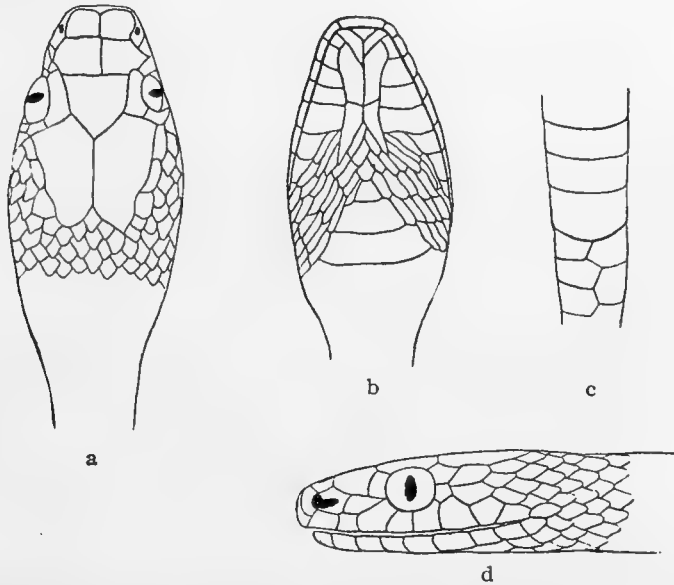


FIG. 43. *Lycopodon ruhstrati*. Cotype.  $\times 2$ . a. Dorsal view of head. b. Ventral view of head. c. Ventral view of cloacal region. d. Lateral view of head. (From Fischer.)

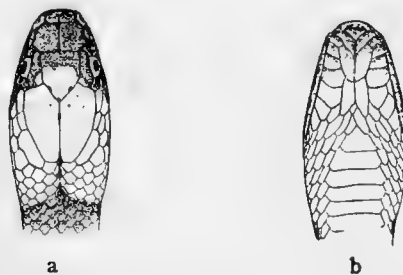


FIG. 44. *Lycopodon ruhstrati*.  $\times 4$ . Juvenile head-pattern. a. Dorsal view. b. Ventral view. A.M.N.H. No. 34106 from Futsing Hsien, Fukien.

A translation of the original description, based on the two cotypes, follows:

**FORM.** Very slender. Body laterally compressed with distinct lateral abdominal angle. Head moderately distinct (with quite young animals broad, more strongly set off from the neck). Tail finely tapering, about  $\frac{1}{6}$  of the total length. Eye small, pupil a vertical oval.

**TEETH.** The dentition is the same that I found in an example of *O. orientalis* from Tokio in Japan (Dresden collection). Four to 5 small, closely crowded teeth of the upper jaw are followed, on a place corresponding to the frenal region, by one or two very large teeth strongly recurved, these in turn by 3 to 4 smaller ones standing rather isolated, and finally a much larger ungrooved tooth in a separate sheath. All these teeth are curved strongly backward. On the gum on each side is a row of small closely crowded teeth. Anterior teeth of lower jaw slightly enlarged.

**HEAD SHIELDS.** Rostral just reaching upwards onto the dorsal surface of the snout. Internasals a little broader than long, shorter than the prefrontals; the latter bent downwards on each side between postnasal and preocular to the frenal. Frontal five-cornered, as broad as long, shorter than the common suture of the large parietals. Nostril deep, situated between two nasals, of which the second is much higher than the first. Frenal pentagonal, twice as long as high, with its posterior point extending below the preocular. The latter well developed, quadrangular, twice as high as long, resting on the third labial and a portion of the frenal, with its upper point extending up onto the dorsal surface of the head, but not reaching the frontal. Two postoculars; the lower rests on the 5th and 6th labials. Temporals 2 + 3, the two of the first row in contact with both postoculars.—Eight supralabials on each side, of which the 3rd, 4th and 5th enter the orbit. Ten pairs of infralabials, those of the first pair in contact on the mental groove, those of the first six pairs in contact with the chin-shields. Of the latter those of the second pair are somewhat narrower and a little shorter than those of the first. They are succeeded by 2 to 3 rows of narrow, oblong throat shields, as far as the abdominal plates.

**BODY SCALES** in 17 longitudinal rows, only those of the 6 to 8 middorsal rows weakly keeled. Ventrals 221 to 223, the lateral portion bent at a distinct though not sharp angle. Anal simple. A simple horny scale follows 103 pairs of subcaudals.

**COLOR.** Head to the middle of the frontal deep black, from there to the third scale of the neck gray in a fully mature specimen (a), pure white in a small juvenile (b). Ground color of the back reddish gray; very many (47 to the vent in a, 36 in b) deep brown, light-edged cross-bands, whose lateral edges descend almost onto the ventral surface; from the second third of the body onward these are cut through, as in *O. orientalis* Hilgd., by a longitudinal line passing along the fourth scale row, so that the lower portions thus isolated form a separate row of spots. Alternating with the latter is a small brown spot on the upturned portion of many of the ventral shields, likewise forming a row of spots on each side. The tail also has a row of deep brown transverse spots above, which in the smaller specimen encircle the ventral surface in the form of complete rings (18 in number). The brown transverse spots of the back become increasingly shorter posteriorly; the first, situated on the nape, extends for more than 17 scale-lengths, the succeeding ones become gradually shorter, until from the second third of the body onward the light interspaces are greater in extent (particularly in the juvenile). The underside of the head and body is yellowish white, that of the tail gray-brown in the adult, in the juvenile, as just said, divided by complete transverse rings.

The hemipenis is essentially like that of *fasciatus*, differing noticeably only in the much greater prominence of the sulcus lips which are, in *ruhstrati*, un-

usually well developed throughout. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—This species is known in China only from Huangchiakou and Mt. Omei in Szechwan; the Lushan in Kiangsi; Chungan and Futsing Hsiens in Fukien; and Lungtou in Kwangtung.

It was described from Formosa but is not known from elsewhere outside of China.

*Habits and Habitat*.—The five specimens of *ruhstrati* secured by me in Fukien were found in forested mountains. Mell (1922, p. 119) found his Lungtou example in a forest, while Maki (1931, p. 126) remarks that it is "not rare in the mountain region of Formosa."

The fact that the three Kuatun individuals collected by me were encountered at night in stream beds (Pope, 1929, p. 429) may be taken as evidence of nocturnal habits and fondness for the proximity of streams. However, the presence of a skink in one and a species of *Takydromus* in another stomach of this series does not suggest a preference for the proximity of flowing water! Perhaps *ruhstrati* was found near the streams only because most of our night hunting was confined to stream beds.

I observed *ruhstrati* to be quick and agile. One individual struck when annoyed (1929, l.c.).

The 672 mm. Chungan Hsien female in the American Museum contains 4 well-developed, elongate eggs, one of which measures 33 x 8 mm. (Pope, 1929, l.c.), but contains no embryo large enough to be revealed by gross examination. It was collected between July 9 and September 3. In this connection, it should be noted that the type and paratype of *futsingensis* were taken on September 3. They are, apparently, juveniles of a single brood, since they are strikingly alike in pattern, exactly the same size, and were found together.

*Material examined*.—I have seen all of the 9 Chinese examples described in Table XXI.

*Remarks*.—Many characters, chief among which are the structure of the hemipenis and the arrangement of the teeth, combine to prove beyond doubt the close alliance of *fasciatus* and *ruhstrati*, and their allocation in different genera is unthinkable. In view of this, and pending a complete revision of the *Lycodon-Dinodon* group, there is little left to do but put *ruhstrati* in the genus *Lycodon* where it must occupy a position near to *fasciatus*.

Stanley's 1914 (p. 27) and 1916 (p. xv) records of "*Lycondon setpentrionalis*" and *Lycodon septentrionalis*, respectively, may be based on specimens of either *L. ruhstrati* or *Dinodon flavozonatum*, or a mixture of both. As indicated under *D. flavozonatum*, Boulenger's 1899 (p. 165) Kuatun record of *Dinodon septentrionalis* is based on three specimens of *flavozonatum*.

49. *Lycodon subcinctus* Boie

## Figure 45

*Lycodon subcinctus* Boie, 1827, Isis, p. 551 (type locality, Java).—Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 202 (Kachek, Hainan).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 440 (Nodoa, Hainan).  
*Ophites subcinctus* Duméril and Bibron, 1854, Erp. Gén., VII, p. 398 (China).  
*Homalopsis buccatus* Hallowell, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 504 (Hongkong) (not of Linnæus, 1758).  
*Anoplophallus maculatus* Cope, 1895, Trans. Amer. Phil. Soc., (2) XVIII, p. 216, Pl. xxiv (not *Megalops maculatus* Hallowell, 1860).

*Description*.—Upper labials 8, 3rd, 4th and 5th entering orbit; loreal entering eye; preoculars absent; postoculars 2; anterior temporals single; posterior temporals 2; scales very feebly keeled, in 17 rows on neck and at mid-body, 15 before vent; ventrals 197; subcaudals 77; length 452+112 mm. Color, black above with narrow, light cross-bands anteriorly; uniform brown posteriorly; light below. (Description based on a female from Nodoa.)

The juvenile specimen secured at Kachek by Smith (1923, p. 202) has 199 ventrals, 78 subcaudals, 13 light cross-bands on the body. All the light bands are presumably distinct, a condition doubtless due to immaturity.

The example in the Naturhistorisches Museum collected by Neumann and labeled Foochow has 221 ventrals, 77 subcaudals, 17-15 scale rows, no preoculars, 2 postoculars, 8 upper labials, the 3rd, 4th and 5th entering the orbit, single anterior temporals, and a total length of only 344 mm. It, too, has distinct, light cross-bands throughout, 12+4 in number.

Mertens (1930, p. 297) records an individual 880 mm. in total length.

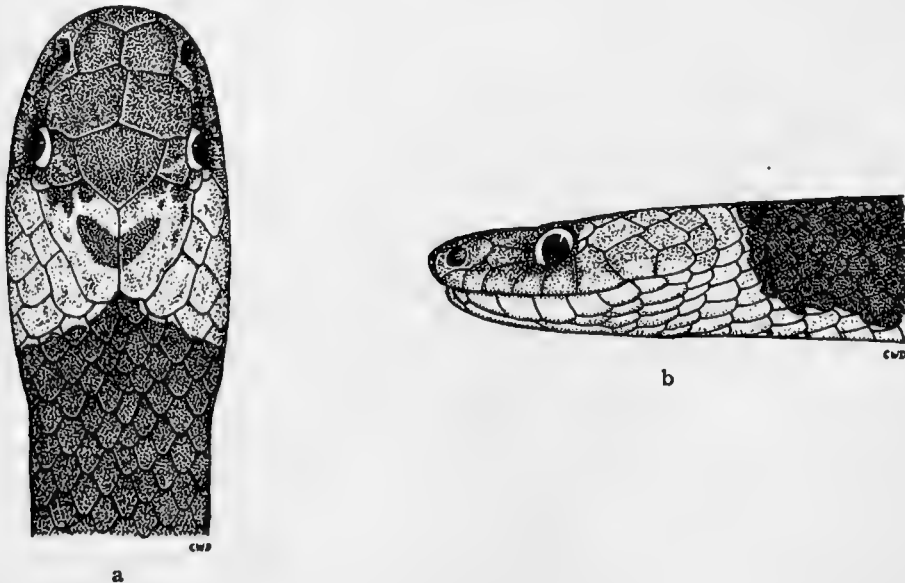


FIG. 45. *Lycodon subcinctus*.  $\times 3$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 27755 from Nodoa, Hainan.



Cope's (1895, Pl. xxiv, fig. 2) figure of *Anoplophallus maculatus* is apparently an illustration of the hemipenis of U. S. Nat. Mus. No. 7359 which, in turn, is the Hongkong specimen of *Lycodon subcinctus* identified by Hallowell in 1860 (p. 504) as "? *Homalopsis buccatus*" (Stejneger, 1925, p. 91, and 1926, Art. 16, pp. 1-3). I have no male *subcinctus* at hand and therefore cannot comment on Cope's figure.

*Distribution*.—In China, *L. subcinctus* has been secured on Hainan and at Foochow. It would be well to have confirmation of the latter record, but, since *subcinctus* is definitely known to occur on Hongkong (Wall, 1903, p. 88), there is little reason to doubt its presence along the southern Chinese coast.

Distributed from southeastern China southward through the Malay Archipelago (Mertens, 1930, l.c.) to Palawan (Taylor, 1922, p. 124).

*Habits and Habitat*.—Although *subcinctus* has been taken only at relatively low altitudes in China, it ascends to at least 5400 feet on the Malay Peninsula (Smith, 1930, p. 46) and to considerable elevations in the East Indies (Mertens, 1930, l.c.).

Mertens (1930, l.c.) found this species on Sumbawa in dry as well as wet situations. He states that it is nocturnal and bites viciously when picked up. A specimen caught by him vibrated the tail just as did one observed by me on Hainan (Schmidt, 1927, p. 441). My Hainan example was discovered on an open, dry hill far from water and actually in the Mission Compound. It was quick in its movements and struck only while crawling.

As far as I can ascertain, *subcinctus* eats only skinks (Guenther, 1864, p. 323, Flower, 1899, p. 665, and Mertens, 1930, p. 298). The Nodoa specimen in the American Museum contains remains of a small *Mabuya multifasciata*, the same species found by Mertens in a Sumbawa specimen.

Kopstein (1930, p. 303, fig. 5) reports that a female, collected in western Java, laid, from May 20-24, 5 eggs measuring 35-36 x 12.5-13 mm. and that these eggs hatched on August 11.

*Material examined*.—I have seen only 2 Chinese specimens, 1 from Nodoa, in the American Museum, the other from Foochow, in the Naturhistorisches Museum, Vienna. I have also examined U. S. Nat. Mus. No. 7359 from Hongkong.

#### Genus *Dinodon* Duméril

*Dinodon* Duméril, 1853, Mém. Acad. Sci. Paris, XXIII, p. 463 (type, *D. cancellatum*).

*Eumesodon* Cope, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 262 (type, *E. semicarinatus*).

*Lepidocephalus* Hallowell, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 498 (same type).

In addition to the species treated below, this genus, as here conceived, includes *D. semicarinatum*, of the Riu Kiu Islands, and *D. orientale*, of Japan proper.

Wall (1911, p. 953) has shown that the generic characters used by Boulenger (1894, p. 1) to separate *Dinodon* and *Lycodon* do not hold. Wall, however, points out that a difference not noticed by Boulenger does exist between the maxillaries of these genera for, in *Dinodon*, there are three teeth in the posterior group but only two in *Lycodon*. I find that this difference seems to hold good for *D. orientale* (U. S. Nat. Mus. No. 34543, maxillary count 5+3+3 right, 5+3+2 or 3 left) and *D. semicarinatum* (U. S. Nat. Mus. No. 7354 A, maxillary count 7+2+3 right, 6+3+3 left) as well as for the species of both genera treated in the present work. Wall (1911, l.c.) found two teeth in the hindermost group of *Lycodon aulicus*, *striatus*, *fasciatus*, *travancoricus*, *jara* and *flavomaculatus*. Although it may be justly argued that such a difference should not be considered of generic importance, I believe that other characters will prove to be corroborative, and certainly the distributions of the respective genera are distinct enough. Unfortunately, lack of material prevents my going into the matter more fully. A comparison of hemipenes will, I think, be most likely to give results.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Color blackish above with numerous, narrow, red or yellow cross-bands; scales smooth or keeled middorsally.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Blackish above with red cross-bands; loreal extended backward, usually entering eye; scales smooth or with a few middorsal rows weakly keeled posteriorly; usually 12 maxillary teeth..... *rufozonatum*, p. 201
- II. Blackish above with yellow cross-bands; loreal seldom extended posteriorly, always excluded from eye; 6 to 9 scale rows more or less distinctly keeled at midbody; 13 maxillary teeth..... *flavozonatum*, p. 198

#### 50. *Dinodon flavozonatum* Pope

Figure 46

*Dinodon septentrionalis* Boulenger, 1899, Proc. Zool. Soc. London, p. 165 (Kuatun, Fukien) (not of Guenther, 1875).

*Dinodon semicarinatus* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 119 (between Linping and Chungsun, Kwangtung, 630 meters) (not of Cope, 1860).—Vogt, 1922, p. 139 (not of Cope, 1860).

*Dinodon flavozonatum* Pope, 1928, Amer. Mus. Novitates, No. 325, p. 2 (type locality, Chungan Hsien, Fukien); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 433, figs. 12 and 13 (amplified description).

*Description*.—Upper labials 8, 3rd, 4th and 5th entering eye; preoculars single; postoculars 2; anterior temporals 2; posterior temporals 2 or 3; scales distinctly keeled, in 17 rows on the neck and at midbody, 15 before vent; ventrals in fifteen males 211-221, in four females 212-218; subcaudals in ten males 81-88, in four females 80-84; light dorsal bands 51 to 78 on body, 17 to 24 on tail; the four largest males measure from snout to vent 825, 815, 805 and 790,

the only four females 671, 668, 590 and 460 mm. (Description based on nineteen paratypes from the type locality.)

The specimen described by Vogt in 1922 (p. 139) as *semicarinatus* is a male with 220 ventrals. It is in the Berlin Museum.

Two paratypes (Nos. 34370 and 34375) agree in having 7+3+3 maxillary teeth on both sides, while a third (No. 34373) has 6+4+3, and still another (No. 34372) 6+4+3 on one side, 7+3+3 on the other. The teeth of the anterior group (6 or 7) noticeably increase in size from front to rear, those of the middle group are subequal in size and relatively small, those of the last unequal in size, the first two being much the larger and rivaling the posterior tooth of the first group in size.

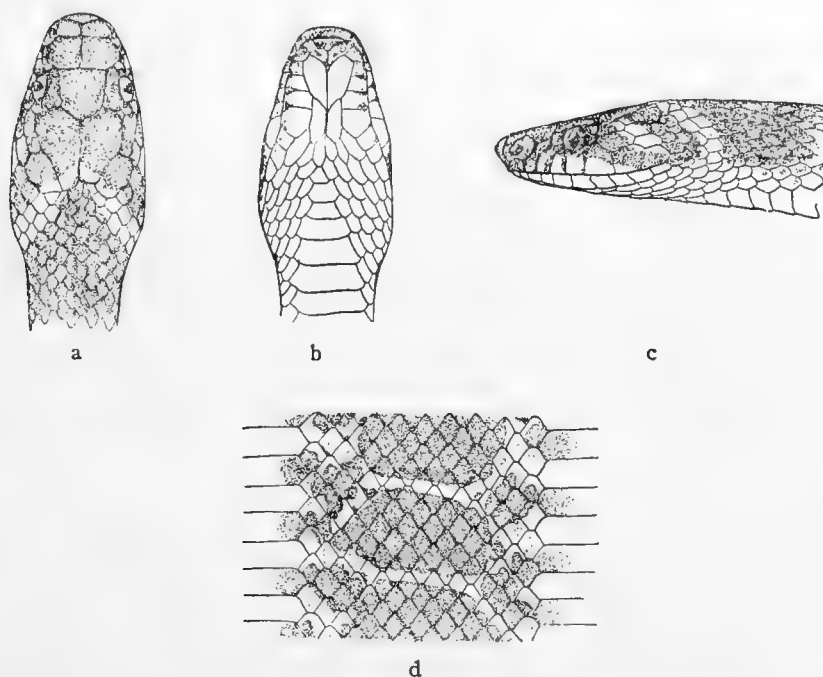


FIG. 46. *Dinodon flavozonatum*. Type.  $\times 2$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. d. Pattern of body.

The original description of the type, a male, follows:

Rostral broader than deep, plainly visible from above; internasals much shorter than prefrontals, which are a little shorter than frontal; frontal slightly longer than broad, just as long as its distance from rostral; length of parietals equals their distance from end of snout. Loreal longer than deep, not entering eye. One pre- and 2 postoculars; temporals 2-3. Eight upper labials, third, fourth, and fifth entering eye; 10 lower labials, first 5 in contact with anterior chin-shields which are as long as, and slightly broader than, posterior. Scales in 17 rows to a point opposite seventy-first ventral plate from anus where fourth row drops out; in 15 rows posterior to this; 7 rows feebly keeled at midbody; all scales smooth on neck. Ven-

trials 218; anal entire; subcaudals 87; apical pits double. Total length 965 mm., 0.20 of which is tail length.

The uniformly black ground-color of the dorsum is crossed anterior to the vent at regular intervals by 68 narrow, yellow bands each about half as wide as a scale is long. Every band divides on the fifth scale-row, each half joining a branch from the adjacent ones before descending to the ventrals. This lateral pattern is not very distinct and encroaches slightly on the white ventrals. Most of the 21 tail-bands are as wide as a scale is long, and none of them splits laterally. The subcaudals are black, weakly light mottled. The top of the head is black save for a yellow stripe from behind the eye to the angle of the mouth; narrow yellow borders on some of the plates, and a nuchal, V-shaped, yellow band with its apex on the posterior tips of the parietals. The first 2 and the eighth or last upper labials are black, the rest black and yellow. The throat is white, except for black trimmings on the anterior lower labials. The yellow of the dorsum fades with preservation into a dirty white.

The hemipenis extends to the twelfth to thirteenth subcaudal plates. It is strikingly like that of *rufozonatum* but differs in certain details as enumerated below:

a. Only bare traces of the papilla-like structures so evident at the extremity of the *rufozonatum* hemipenis are discernible in *flavozonatum*, the end of the organ in this form being almost perfectly smooth.

b. The minute spines of *rufozonatum* are greatly thickened basally, while those of the other species are only moderately so thickened.

c. The longitudinal ridge enclosing the sulcus is nearly uniformly developed throughout in *flavozonatum*, while in *rufozonatum* it is poorly developed proximally, well developed distally, and abruptly reduced in size near the extremity of the organ.

*Distribution*.—This species has been secured only in Chungan Hsien, northern Fukien; and from between Linping and Chungsun in northern Kwangtung.

*Habits and Habitat*.—*Dinodon flavozonatum* was encountered by me only in the high forests about Kuatun and Sanchiang where it was not uncommon. Mell (1922, p. 119) also secured it at considerable altitude (650 meters) in Kwangtung.

This species resembles *rufozonatum* in disposition (Pope, 1929, p. 434).

One of the paratypes had eaten a lizard (*Takydromus*), another a skink and a third a fully adult *Amblycephalus stanleyi* (not a "snake of the genus *Holarchus*" as originally stated by me in 1929 on page 434).

*Material examined*.—I have seen the following material: the type and 19 paratypes, in the American Museum; 2 specimens from Kuatun, in the British Museum; 1 from between Linping and Chungsun, in the Berlin Museum; and 1 from Kuatun, in the U. S. National Museum (received in exchange from the British Museum).

*Remarks*.—The relationship of the present species to *rufozonatum* is undoubtedly close but the two forms are, nevertheless, quite distinct. Due to my

failure to emphasize their differences, Werner (1929, p. 59) and Chang (1932, p. 55) have been led to discredit the specific distinctness of *flavozonatum*. In order to settle the matter finally, I have prepared the following list of major reasons for separating the two forms:

1. The hemipenes of the two snakes differ as explained in detail above.
2. The narrow dorsal bands are constantly red in *rufozonatum*, but yellow in *flavozonatum*, and this character is just as reliable in northwestern Fukien where the ranges of the species overlap as elsewhere.
3. The loreal is constantly well separated from the eye in all of the twenty Chungan Hsien *flavozonatum*, while it enters the orbit in eleven of the twelve Fukien and Kiangsi *rufozonatum* recorded by me in 1929 (p. 432). Schmidt (1927, p. 524) found that it enters the eye in 69% of the fifteen Anhwei *rufozonatum* reported by him. Although an occasional *rufozonatum* loreal may match a *flavozonatum* one in shape, this scale is nearly always much more elongate and posteriorly extended in the former than in the latter species.
4. *D. rufozonatum* is essentially a smooth scaled snake with faint keels frequently present far posteriorly on a few middorsal rows, but *flavozonatum* constantly has from six to nine rows more or less distinctly though not heavily keeled at midbody.
5. *D. flavozonatum* usually has a slightly higher maxillary tooth count than *rufozonatum*.
6. *D. flavozonatum* is a more slender snake than *rufozonatum* and probably never attains the girth constantly reached by that form.
7. As far as is known, *flavozonatum* is solely an inhabitant of high, mountain forests, while the red-banded species, except along the southern periphery of its range, frequents low, open country.

#### 51. *Dinodon rufozonatum* (Cantor)

##### Figure 47

- Lycodon rufo-zonatus* Cantor, 1842, Ann. Mag. Nat. Hist., IX, p. 483 (type locality, Chusan Island).  
*Dinodon cancellatum* Duméril and Bibron, 1854, Erp. Gén., VII, p. 447 (type locality unknown).  
*Coronella striata* Hallowell, 1856, Proc. Acad. Nat. Sci. Phila., VIII, p. 152 (type locality, Ningpo).  
*Eumesodon striatus* Cope, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 263.  
*Dinodon rufozonatus* Peters, 1881, Sitzber. Ges. Naturf. Freunde Berlin, p. 89 (China).  
*Dianodon rufozonatus* Cope, 1895, Trans. Amer. Phil. Soc., (2) XVIII, p. 215, Pl. xx (hemipenis of Chinese specimen figured).  
*Dinodon rufozonatum* Stejneger, 1907, Herp. Japan, p. 358 (Peiping).  
*Lycondon rufozonatus* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 26 (Fukien; Ningpo; Shanghai, Soochow and Wusih, Kiangsu; Tatung, Anhwei; Kiukiang, Kiangsi; Szechwan; Tsinan, Shantung; and Peiping).  
*Dinodon rufozonatum williamsi* Schmidt, 1925, Amer. Mus. Novitates, No. 175, p. 2 (type locality, Changsha, Hunan); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 525, fig. 15 (amplified description).—Pope, 1929, LVIII, p. 431 (Yenping and Chungan Hsien, Fukien; Hokow, Kiangsi).  
*Dinodon rufozonatum rufozonatum* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 523 (Hsinglungshan, Hopei; Niangtzekwan and Chintzu, Shansi; Ningkwo and Wuhu, Anhwei).  
*Dinodon rufozonatum yunnanense* Mell, 1929, Lingnan Sci. Journ., VIII, p. 207 (type locality, western Yunnan).

*Description*.—Upper labials 8; preoculars single; postoculars 2; anterior temporals 2; posterior temporals 3, very rarely 2; scales smooth or very faintly keeled posteriorly, in 17, rarely 19, very rarely 20, rows on the neck, 17, rarely 19, at midbody, and 15, very rarely 17, before the vent; ventrals in eight males 195-198, in nine females 191-197; subcaudals in seven males 67-69, in eight

females 64-68; narrow dorsal cross-bands in fourteen specimens 45-66 on body, 16-23 on tail; three largest males from snout to vent 910, 859 and 810, three largest females 980, 825 and 810 mm. Color, black with narrow, red cross-bands; head black, the plates conspicuously margined with red; pale yellow below. (Description based on seventeen specimens from the Western Hills.)

This species is remarkable in lacking the usual distinct sexual dimorphism in ventral counts. In fact, the higher number of ventrals is more often seen in the males of *rufozonatum* but the difference is never great. Females appear to exceed the males somewhat in size even though the difference is not always noticeable (Pope, 1929, p. 432, Chang and Fang, 1931, p. 278, and the foregoing description).

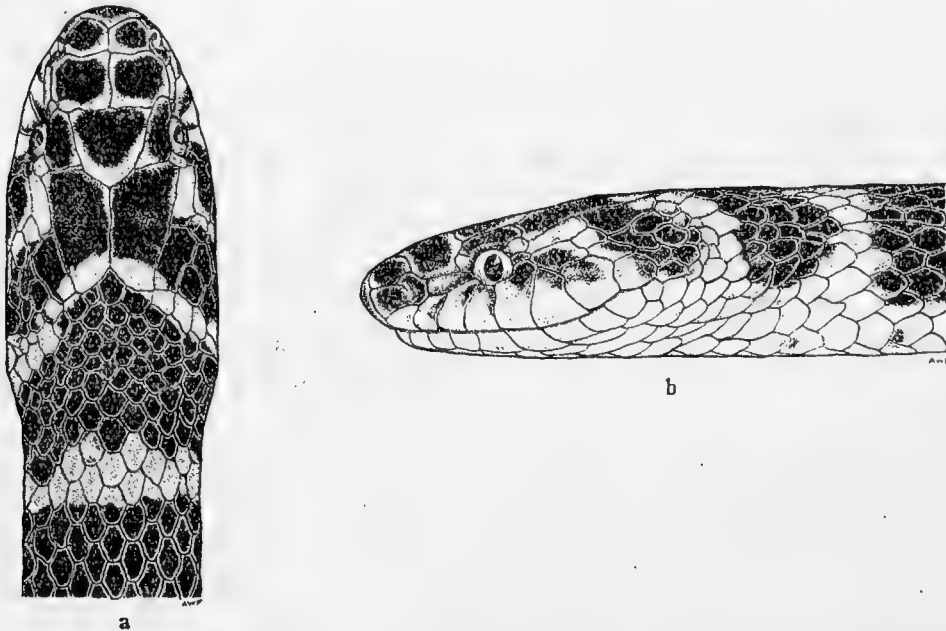


FIG. 47. *Dinodon rufozonatum*.  $\times 1\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 29392 from the Western Hills, Hopei.

Schmidt's (1925, No. 175, p. 2, and 1927, p. 525) subspecies *williamsi* was based on Changsha specimens with rather high ventral, subcaudal and dorsal cross-band counts, but a study of material from widely separated localities proves that these high counts do not vary consistently with geographical distribution but rather with altitude, and even this correlation does not hold in Korea where high counts prevail at low altitude, or in southwestern Szechwan and northern Yunnan, where low counts are found at high elevations. It can only be said that *rufozonatum* exhibits slight but definite tendencies to increase or reduce its number of vertebræ and cross-bands whenever subjected to a certain degree of isolation. Table XXII giving selected counts will serve to

TABLE XXII. VENTRAL, SUBCAUDAL AND DORSAL CROSS-BAND COUNTS OF *DINODON RUFOZONATUM* FROM CHINA AND KOREA

<i>Locality</i>	<i>Sex and Number of Specimens</i>	<i>Ventrals</i>	<i>Subcaudals</i>	<i>Light Dorsal Cross-bands</i>	<i>Museum or Reference</i>
Yenping.....	1 ♂	213	79	61 + 19	Amer. Mus.
Chungan Hsien.....	9	207-219	(6)80-88	56-74 + (6)16-29	Amer. Mus.
Hokow.....	1 ♀ + 1 ♂	209 and 212	76 and 79	63 and 54 + 15 and 20	Amer. Mus.
Ningpo.....	1 ♀	197	69	54 + 15	Mus. Comp. Zool.
Shanghai.....	4	185-201	57-69		Boulenger, 1893, p. 362
Nanking.....	10	189-209	61-75		Chang and Fang, 1931, p. 278
Ningkwo and Wuhu...	13	196-205	(11)65-84		Amer. Mus.
Lushan.....	2	203	67-72		Boulenger, 1893, p. 362
Changsha.....	6	207-213	77-86	59-87 + 21-34	Amer. Mus.
S. W. Hunan.....	2	211-212	82-88		U. S. Nat. Mus.
between Yungning, Yungpeh and Likang.	1 ♂	187	67		Werner, 1924, p. 46
Ningyuan.....	2	185-186	(1)68		U. S. Nat. Mus.
Süchow.....	5	208-221	(2)85-86		U. S. Nat. Mus.
Kiating.....	1	204	72		Boulenger, 1893, p. 362
Hsiaomienhsi, Hochuan.	1	213	70	65 + 18	Chang, 1932, p. 54
Ichang.....	1 ♀	201		67 + 16	Mus. Comp. Zool.
Chintzu.....	1 ♂	198	64	56 + 19	Amer. Mus.
Niangtzekwan.....	1 ♂	198	73	61 + 21	Amer. Mus.
Peiping.....	10	192-200	(9)64-74		Tchang, 1932, p. 3
Hsinglungshan.....	1 ♂ + 1 ♀	193 and 195	68 and ?	63 + 20 and 51 + ?	Amer. Mus.
Tsinan region.....	11	197-203	(9)66-76	62-85 + 20-28	Amer. Mus.
Keijo, Korea.....	1 ♀	210	63	75 + 17	Maki, 1931, p. 121
Fusan, Korea.....	1 ♂	201	73		Slevin, 1925, p. 99

illustrate this point. The figures in parentheses indicate the number of specimens on which the count is based when the number is less than that given in the second column, differences due chiefly to mutilated tails.

Three specimens in the American Museum (Nos. 17454 and 29392-93) agree in having 6 + 3 + 3 maxillary teeth on each side, while a fourth (No. 17455) has 7 + 3 + 3 on both sides. In group arrangement as well as relative size of the teeth within each group, *rufozonatum* resembles *flavozonatum*. Wall (1911, p. 953) has already pointed out one error in Boulenger's 1894, p. 360, figure of the *rufozonatum* maxilla, while in all probability a second one also exists, i.e., the anterior group is shown with one or even two too few teeth.

Cope's (1895, Pl. xx, fig. 10) figure of the *rufozonatum* hemipenis is inaccurate in the following respects:

1. The calyces as shown cover a much too extensive area and are too uniform in structure.
2. The papilla-like structures found at the extremity of the organ are entirely omitted by Cope.
3. The longitudinal ridge involving the sulcus is actually much larger and more conspicuous distally than proximally but ends abruptly just proximal to the tip of the hemipenis. In Cope's illustration this ridge appears to be uniformly developed throughout.

One or two characters in addition to those discussed here or discernible in Cope's figure are described under *D. flavozonatum* where the hemipenes of that species and the present one are compared.

*Distribution*.—*Dinodon rufozonatum* is known from the following localities in China:

Yunnan: Tali; between Yungning, Yungpeh and Likiang.  
 Szechwan: Ningyuan; Chengtu; Kiating; Süchow; Suining; Hsiaomienhsi, Hochuan.  
 Hunan: southwestern part; Changsha.  
 Hupeh: Ichang; Hankow.  
 Kiangsi: Kiukiang; Lushan and Kuling; Hokow.  
 Fukien: Foochow; Yenping; Chungan Hsien.  
 Chekiang: Chusan Island; Ningpo and region; Hangchow; Kashing.  
 Anhwei: Tatung; Ningkwo; Wuhu; Chuchow.  
 Kiangsu: Shanghai and region; Soochow; Wusih; Nanking.  
 Shantung: Tsingtao region; Weihsien; Tsinan and region.  
 Hopei: Tsangchow; Peiping; Western Hills; Hsinglungshan.  
 Shansi: Niangtzekwan; Chintzu.

I am unable to locate Stanley's (1917, p. xiii) "Pingchiao Quarry." Boulenger's 1893 (p. 361) Hoihow record may now be disregarded (Stejneger, 1907, p. 318), while I have determined by direct examination that the Laos snake questionably referred to the present species by Angel (1929, p. 79) is altogether a different form.

Maki (1931, p. 119) reports *rufozonatum* as common on Formosa and Tsushima but rarer in Korea, and Mori (1929, p. 3) includes it in his list of Quelpart



reptiles. Although rare in Manchuria (Sowerby, 1930, p. 19), it has been reported as far north as Harbin (Mori, 1927, p. 142). Emelianov (1929, p. 41) has failed to secure confirmation of Müller's 1892 (p. 205) Vladivostok record, so it is presumably lacking in the coastal region of eastern Asia north of Korea.

*Habits and Habitat*:—There is much difference of opinion in regard to the habitat preference of this snake, for it has been described as "perfectly terrestrial" (Chang and Fang, 1931, p. 278), as a "land snake" (Boring, Liu and Chou, 1932, p. 60) and as a "field snake" (Stanley, 1914, p. 26), on the one hand, but as "aquatic," or "more commonly found about water courses" (Jacot, 1931, p. 42, and 1923, p. 260), and "very common in the proximity of water" (Maki, 1931, l.c.), on the other. Moreover, Chang and Fang (1931, l.c.) state that it lives in houses. My own observations (partly stated in 1929, pp. 431 and 433) confirm all of the diversified opinions enumerated above, and I believe that, in the low country of central China, *rufozonatum* not only constantly frequents the vicinity of water but occurs almost everywhere else as well. Its feeding habits support these conclusions as shown in detail below.

The vertical range of *rufozonatum* is very great, as is proved by its presence in the mountains of northern Hopei (Hsinglungshan), Fukien (Chungan Hsien), Szechwan (U. S. Nat. Mus. Nos. 76248-9 from Ningyuan collected at 6200 feet) and northern Yunnan (Mell, 1922, p. 119, and Werner, 1924, p. 46). In spite of these altitude records, the snake in question is really more at home in the river plains and slightly elevated regions of central China.

In China, *D. rufozonatum* is known to be common at Shanghai (Wall, 1903, p. 89, etc.); Kiukiang and in the Lushan (Guenther, 1888, p. 171, and 1892, p. 241); about Tali (Mell, 1922, l.c.); at Kiating (Guenther, 1892, l.c.); and Peiping (Boring, Liu and Chou, 1932, l.c.). I found it abundant at Ningkwo but much less evident in the Kuatun-Sanchiang mountains (1929, p. 433).

The relatively omnivorous feeding habits of *rufozonatum* deserve special notice. It has been known to eat fishes, frogs (*Rana* and *Bufo*), lizards, snakes, young birds and even a guinea pig! The following data illustrate the point in question:

1. Wall (1903, l.c.) found a toad (*Bufo*) in the stomach of a specimen from the Shanghai region.

2. Jacot (1923, l.c.) states that *rufozonatum* feeds on frogs and toads in Shantung.

3. Chang and Fang (1931, l.c.) discovered beetles and ants in Nanking specimens. This fact points to the consumption of amphibians, probably toads. Another Nanking *rufozonatum* had devoured a young guinea pig.

4. Maki (1931, l.c.) finds that Formosan *rufozonatum* preys on toads (*Bufo*), smaller snakes and fishes.

5. An 850 mm. specimen was brought to my camp at Hsinglungshan in the act of swallowing a 440 mm. viper (*Agkistrodon*), while, near Ningkwo, I caught a *rufozonatum* by means of a frog tied to a long string. At Chintzu, in Shansi, I fed captive individuals on young birds,

juvenile *Elaphe dione*, frogs and toads (*Rana nigromaculata* and small *Bufo bufo gargarizans*), geckos and other lizards (*Eremias*).

Dissection of specimens in the American Museum has given the results set forth in Table XXIII.

TABLE XXIII. FOOD OF *DINODON RUFOZONATUM* FROM CHINA

<i>Locality</i>	<i>Number of Specimens</i>	<i>Prey</i>
Tsinan region.....	1	frog ( <i>Rana</i> )
Western Hills.....	1	frog ( <i>Rana nigromaculata</i> )
Western Hills.....	1	toad ( <i>Bufo bufo gargarizans</i> )
Chintzu.....	2	unidentifiable remains of fish
Chintzu.....	1	loach ( <i>Barbatula</i> )
Chintzu.....	1	lizard ( <i>Eremias</i> )
Ningkwo.....	1	frog ( <i>Rana limnocharis</i> )
Ningkwo.....	1	frog ( <i>Rana</i> )
Ningkwo.....	1	unidentifiable remains of a frog
Yenping.....	1	loach ( <i>Misgurnus</i> )
Chungan Hsien.....	1	frog
Chungan Hsien.....	1	skink ( <i>Eumeces elegans</i> )
Chungan Hsien.....	1	skink

All the notes on the feeding habits of *rufozonatum* formerly given by me (1929 on pp. 431 and 432) have been incorporated in the table.

In 1929 (p. 431), I reported that 11 well-developed eggs, one of which measured 15 x 13 mm., were found in a female, while a second individual contained 8 well-formed and 3 poorly developed ones. Both of these specimens are from the Tsinan region and measure 775 and 930 mm. in body length, respectively. Two additional specimens in the American Museum, both from Changsha, are embryos obviously on the point of hatching. The eggs from which they were taken are 33 and 38 mm. in greater diameter, while the snakes themselves measure 232 and 242 mm., total length. Each has an egg-tooth. The color pattern of these snakes is similar to that of the adults from the same locality. The extreme scarcity of references in the literature to the breeding habits of this species is indeed puzzling.

Wall (1903, l.c.) collected this snake near Shanghai and observed that its disposition is good, freshly caught specimens crawling composedly over their captor without biting or making serious attempts to escape. I have handled scores of individuals and arrived at the same conclusion, with the single reservation that a small percentage of individuals are treacherous, at times biting without notice. Instead of striking, these more aggressive individuals simply open the mouth and quietly bury the teeth in the flesh that happens to be nearest to their jaws. I also noticed that, when alarmed, *rufozonatum* sometimes rolls itself into a compact, spherical mass. All observers agree that it is nocturnal. In general, it does not constrict its prey but on one occasion I saw a very weak individual attempt to overcome a toad by constriction.

*Material examined*:—I have examined, among many others, the following specimens from China: 1 from Foochow, in the Naturhistorisches Museum, Vienna; and another from the same locality, in the Museum of Comparative Zoölogy; 1 each from Hankow and Foochow, and 2 from Ningyuan, in the U. S. National Museum.

*Remarks*:—The relationship of *rufozonatum* to *flavozonatum* is discussed in detail under the latter.

American Museum Nos. 21473 and 21474 were collected actually at Hsing-lungshan, *not* 26 miles south of this locality as recorded by Schmidt, 1927, p. 523. One of these specimens is included in the table of ventral, subcaudal and dorsal cross-band counts.

#### Genus *Zaocys* Cope

*Zaocys* Cope, 1861, Proc. Acad. Nat. Sci. Phila., XII, p. 563 (type, *Coluber dhumnades*).

In addition to those included below, this genus comprises four species, namely, *luzonensis* of the Philippine Islands, *fuscus* of the Malay Archipelago, *tenasserimensis* of Tenasserim, and *carinatus* which is widely distributed from northern Siam southward into the Malay Archipelago.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Size large; scales in even number of rows; alert, and quick in movements.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Black longitudinal lines more or less evident throughout length of body..... *dhumnades*, p. 208
- II. Black longitudinal lines never present anteriorly, more or less evident posteriorly..... *nigromarginatus*, p. 214

The strong tendency of many individuals of these two species to become uniformly black, even with early maturity, often makes their identification very difficult. When dark or black specimens are in hand, a close scrutiny from

various angles in different lights will often enable one to detect the fundamental pattern obscured by the ontogenetic melanism and accomplish an identification which at first seemed impossible. Placing an individual under water sometimes helps greatly in making out the basic pattern.

## 52. *Zaocys dhumnales dhumnales* (Cantor)

Figures 48, and 49, b

*Coluber dhumnales* Cantor, 1842, Ann. Mag. Nat. Hist., IX, p. 483 (type locality, Chusan Island).

*Ablabes vittatus* Duméril and Bibron, 1854, Erp. Gén., VII, p. 326 (type locality, China).

*Zaocys dhumnales* Cope, 1861, Proc. Acad. Nat. Sci. Phila., XII, p. 563 (Ningpo).

*Coryphodon dhumnales* Müller, 1878, Verh. Naturf. Ges. Basel, VI, p. 61 (China).

*Description*.—The head plates of this form are strikingly like those of *montanus*. The scale formula is 16-14.

Table XXIV shows the ventral and subcaudal counts for two series, the figures in parentheses indicating the number of specimens counted.

TABLE XXIV. VENTRAL AND SUBCAUDAL COUNTS OF *ZAOCYS DHUMNALES DHUMNALES* FROM KIANGSU AND ANHWEI

Locality	Sex	Ventrals		Subcaudals		Reference
		Range	Average	Range	Average	
Nanking. . . . .	♂	(11)190-195	193.3	(6)109-119	113.2	Chang and Fang, 1931, p. 267
Nanking. . . . .	♀	(19)189-197	196.3	(12)108-124	115.0	Chang and Fang, 1931, p. 267
Ningkwo. . . . .	♂ + ♀	(25)186-197	192.0	(9)105-118	113.0	Schmidt, 1927, p. 522

Among eighteen Ningkwo examples, I find that 2 middorsal rows are keeled at midbody in sixteen, 4 in the remaining two, while before the vent, 2 rows are keeled in fifteen, 4 in the remaining three. On the other hand, in Nanking material, Chang and Fang (1931, p. 267) reported variation in the "dorsal keeling from 2 to 6, 2 in six, 4 in ten, . . . and 6 in the remaining cases." They apparently had a series of thirty individuals.

Chang and Fang, as shown in the foregoing table, indicate that in Nanking material, females have a higher average subcaudal count than males. This condition is very unusual and warrants further investigation. They give the maximum total length among twelve females and six males as 1955 mm. and 1865 mm., respectively.

*Distribution*.—As here conceived, typical *dhumnales* is found chiefly at low altitudes in the Yangtze Valley. The following localities at which it has been secured will serve to define its range more definitely:

Chekiang: Chusan Id.; Ningpo and region; Hangchow; Tunghu.

Kiangsi: Lushan and Kiukiang.

Anhwei: Ningkwo; Chuchow.

Kiangsu: Nanking; Soochow; Shanghai and region.

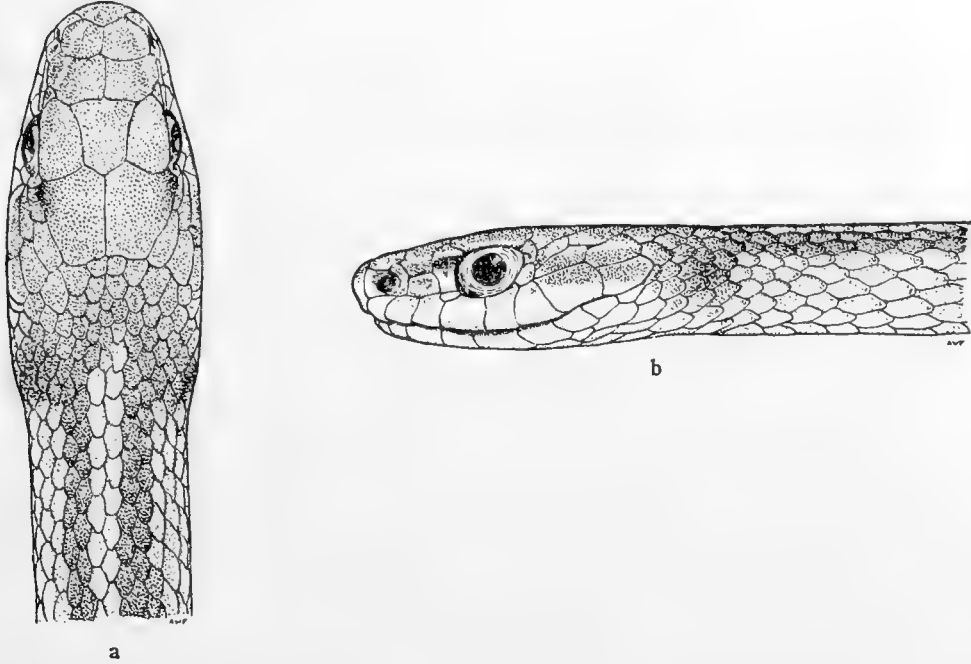


FIG. 48. *Zaoecys dhumnades dhumnades*.  $\times 1\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 24521 from Ningkwo, Anhwei.

In 1929 (p. 415), I recorded one of the four Changsha specimens in the American Museum as typical *dhumnades* because of its low subcaudal count (112), but re-examination shows that its tail is incomplete and I am therefore considering it as *montanus*. This is more reasonable in view of the fact that the subcaudals in the other three Changsha examples number 117, 119 and 122, but only the tail of the latter is undamaged and even that one may have lost a few subcaudals. All four are males.

*Habits and Habitat*.—Wall (1903, p. 90) has given an excellent account of this snake as follows:

A very common snake about Shanghai and evidently throughout the Yangtse Valley, for there are many specimens in the Siccawei Museum. I have encountered it frequently, and consider its generic name most apt, as it is very active, swift, and clever to elude capture. I saw as many as four in a day's ramble in the spring, when batrachians were clamouring in the water engaged on matrimonial matters. The snakes were each coiled up on the banks close to the water, and in low vegetation, awaiting the excursion of some unwary individual. One I saw coiled up similarly two yards or so away from two toads [*Bufo bufo gargarizans*], whose

curious behaviour it was that first attracted my attention. In spite of every care my presence was always detected by the snake before I was aware of its presence, and it immediately made off in great haste for the water, and disappeared among the roots of the aquatic vegetation. On one occasion in the summer I watched one for some time in a strip of grass in the open, myself unobserved; and it was most interesting to notice the method and care with which it beat the patch of grass like a harrier, prying into every recess in the ground or tussock that might harbour some possible prey. I have seen Chinese jugglers with this snake in their stock in trade, and I believe that it is this species that is even now occasionally met with in houses in the heart of the town of Shanghai. On October 3rd, 1901, I captured a young one recently hatched in camp which closely resembled the adult in colouring.

My observations in the Ningkwo region, where I found this snake abundant along overgrown terraces and streams, in grassy fields and ravines, or near the edges of groves of trees, confirm Wall's in nearly every detail.

I secured concrete evidence of *dhumnades*' fondness for frogs on several occasions in the field and now find frog remains in the stomachs of three Ningkwo specimens, one of the three, a half-grown individual, holding no fewer than four *Rana limnocharis*. It is highly probable that the vicinity of water is frequently haunted because of the abundance of food there.

*Zaocys dhumnades* is nervous and irritable but not vicious, some individuals being reluctant to bite until hard pressed. It has the habit of dashing away with great speed only to stop suddenly when cover is reached, the result being that it often seems to vanish completely. All the activity described above was observed during broad daylight, so this snake is certainly diurnal.

The eggs adhere to one another when laid, number 13-17 to a clutch, and measure 35-65 x 20-30 mm. The shell is milky or pinkish white and has a rough surface. When deposited, the eggs contain rather advanced embryos. Oviposition requires about three hours for completion. (Chang and Fang, 1931, p. 268.)

*Material examined*:—I have seen the following material: 25 specimens from Ningkwo, in the American Museum; the cotypes, and 3 from the Lushan, in the British Museum; 2 from Shanghai, and 1 from the Lushan, in the Senckenbergisches Museum, Frankfurt; 1 each from Shanghai, Ningpo and the Lushan, in the Naturhistorisches Museum, Vienna; and 5 from Tunglu, in the Museum of Comparative Zoölogy.

### 53. *Zaocys dhumnades montanus* Pope

*Zaocys dhumnades* Guenther, 1896, Ann. Mus. Zool. Acad. Sci. St. Pétersbourg, I, p. 205 (Lungan, Szechwan) (not of Cantor, 1842).—Stanley, 1916, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLVII, p. xiv (Suining, Szechwan) (not of Cantor, 1842).—Werner, 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 47 (Hsikwangshan near Sinhwa, Hunan, 600 meters) (not of Cantor, 1842).

*Zaocys dhumnades* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 119 (part: northern Kwangtung, near the Hunan boundary).

*Zaocys nigromarginatus* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 87 (Suchow and Mt. Omei, Szechwan) (not of Blyth, 1854).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 522 (part: Luan-

shihkou and Wanhsien, Szechwan).—Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 50, figs. 15 and 16 (Chungking and vicinity, Szechwan, 500-700 meters; Hochuan and vicinity, Szechwan, 700-720 meters; Chengtu, Szechwan, about 600-700 meters; and Mt. Omei, Szechwan, 860 meters) (not of Blyth, 1854).

*Zaocys dhumnades montanus* Pope, 1928, Amer. Mus. Novitates, No. 325, p. 2 (type locality, Chungan Hsien, Fukien; paratypes from Yenping, Fukien; and Changsha, Hunan); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 417 (amplified description).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 75 (Lohsiang, Kwangsi).—Angel and Bourret, 1933, Bull. Soc. Zool. France, LVIII, p. 133 (Chapa, Tongking, about 1500 meters).

*Zaocys dhumnades dhumnades* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 417 (Changsha, Hunan) (not of Cantor, 1842).

*Zaocys nigromarginatus nigromarginatus* Mell, 1931, Lingnan Sci. Journ., VIII, p. 207 (part: Szechwan).

*Description*.—Upper labials 8, very rarely 9; preoculars 2; postoculars 2; anterior temporals 2, rarely 1; posterior temporals 2, very rarely 3; scales 16-14, 2 middorsal rows keeled save on neck, rarely 4 rows keeled posteriorly; ventrals in nine males 191-203, in two females 200-203; subcaudals in one male 131+, in one female 137. (Description based on eleven paratypes from Chungan Hsien.)

Nearly all the eleven paratypes described above were skinned in the field, so accurate measurements are not available, but the skin of the longest individual, a female, is 2300 mm. in total length. The Chapa specimen recorded by Angel and Bourret (1933, p. 133) has a total length of 2561 mm. Its ventral and subcaudal counts are 209 and 137, respectively.

Szechwan specimens generally have 6 middorsal rows keeled and are much darker than those from farther east. Additional material may show that a subspecific distinction can be made on the basis of these characters, but the matter is complicated enough at present and should not be made more so. The amount of keeling is, moreover, very variable.

The original description of the type, a female, follows:

Rostral broader than deep, visible from above; internasals shorter than the prefrontals, which are not as long as their distance from end of snout; frontal almost as long as its distance from tip of snout, just as long as parietals which are nearly as broad as long. Loreal longer than deep; a large preocular with a small one below; 2 postoculars; 2 anterior, and 2 posterior temporals. Eight upper labials, fourth and fifth entering eye; 10 lower labials, first 5 in contact with anterior chin-shields. Scales reduced from maximum of 16 to minimum of 14 at a point opposite 103d ventral; smooth on neck, 2 rows sharply keeled at midbody and before vent. Ventrals 195; anal divided; subcaudals 123+. Total length 1475 mm.+, about 0.28 occupied by tail.

The posterior half of the body above and below is slaty black. The milky color of the throat and ventral surface of the head merges with the darkening belly color. Anteriorly, on either side of the 2 mid-dorsal rows of scales, is a black stripe, itself covering 2 scale rows. Below this stripe the scales have black borders and bluish centers. The lateral tips of the ventrals are edged with black. Some distance posterior to the head the scales of the third row lose their light centers forming a narrow, black stripe that is soon lost in the uniform black of the posterior section of the snake. The top and upper sides of the head are slate-colored.

The hemipenis is not divided and extends to a point opposite the eleventh to twelfth subcaudal plates. Proximally, two large basal spines or hooks lie adjacent to each other but removed from the sulcus by a small space. A spinous area begins immediately distal to the hooks. Its spines extend in four or five poorly defined series across the organ, and are short, thick and relatively uniform in size. Each spine is surmounted by a sharp point. These spines give way abruptly to a calyculate area occupying nearly two thirds of the entire hemipenis. The edges of the calyces are finely and shallowly scalloped, while the calyces themselves gradually decrease in size toward the end of the organ. This decrease in size is not uniform, for the calyces opposite the sulcus maintain a larger size than those adjacent to it and end at a point a little distal to them. Moreover, these larger and more persistent calyces tend to become flounce-like in appearance, due chiefly to a reduction in size of the longitudinal connecting walls. The lips of the sulcus are calyculate in the calyculate region but almost entirely smooth in the spinous area. (Description based on a specimen from Luanshihkou.)

*Distribution*.—I am considering *montanus* as the form that supplants typical *dhumnades* in greatly elevated plateau regions and high mountains from western Szechwan to the mountains of Fukien, Kwangtung, Kwangsi and Tongking (Angel, 1933, p. 133).

The following locality records are probably based on this highland form:

Fukien: Yenping and Chungan Hsien.

Kwangtung: mountains of the extreme north, near the Hunan boundary.

Kwangsi: Lohsiang.

Hunan: Changsha; Hsikwangshan.

Szechwan: Wanhsien; Luanshihkou; Chungking and vicinity; Hochuan and vicinity;

Suining; Süchow; "Ngaulinchiao," east of Süchow; Mt. Omei; Chengtu; Lungan.

Tongking: Chapa.

Stanley's (1914, p. 27) record for Sian requires confirmation. Boettger's (1898, p. 40) Hongkong record is possibly based on transported material, but the recent (Angel, 1933, p. 133) discovery of *montanus* in Tongking removes much of the doubt from this record. Indisputable confirmation of its presence on Hongkong would be most welcome.

*Habits and Habitat*.—This snake is not uncommon in the Sanchiang mountains of Chungan Hsien, where the type and eleven paratypes were secured.

Three of the four Changsha specimens in the American Museum contain remains of frogs. These remains in two of the three are readily identifiable as *Rana rugulosa*.

The type was collected between April 25 and September 3 and holds 5 well-developed eggs. Another Chungan Hsien specimen measures 1125 mm. from



snout to vent and contains 10 advanced eggs, one of which is 47 x 15 mm. in greater and lesser diameters. The embryos in these clutches are still in the earliest stages of development. The female with 10 eggs was secured between June 12 and July 20.

*Material examined*.—I have seen the following specimens: 12 from Chung-an Hsien, 1 from Yenping, 4 from Changsha, 1 from Luanshihkou, and 2 from Wanhshien, in the American Museum; 3 from Kwangtung and 3 from Chengtu, in the Berlin Museum; a large series from Sūchow, 2 from Mt. Omei, and 1 from "Ngaulinchiao," east of Sūchow, 1500 feet, in the U. S. National Museum.

*Remarks*.—The solution of the problem presented by the Chinese snakes obviously belonging to some form of *dhumnades* would be relatively simple were it not for the aggravating coincidence that the most difficult character to secure is also the most valuable one in distinguishing the forms involved. This character, the subcaudal count, can be determined in only a small percentage of the specimens collected because nearly all of these snakes suffer injury to the tail long before maturity. For example, only one individual among twelve collected in Chungan Hsien possessed a perfect tail! In describing material, few workers have made careful examinations of the tails handled and consequently published counts cannot be relied upon. As a result of these unusual conditions, I have been forced to base some of my conclusions upon analogy. However, the few available facts convince me that the snakes of the Yangtze and coastal lowlands have a constantly smaller average subcaudal count (about 114 for the combined sexes) than those of the eastern mountains, and western plateaus and mountains (at least 125). It would be only a waste of time to review a lot of counts almost certainly taken from specimens with incomplete tails, but two facts are worth recording: (1) Among twenty-seven snakes from Nanking and Ningkwo, recorded as possessing complete tails, no one had more than 124 subcaudals (Schmidt, 1927, p. 522, and Chang and Fang, 1931, p. 268); (2) Among twelve snakes from the mountains of Chungan Hsien (type and paratypes of *montanus*), four individuals had more than 124 subcaudals, and yet in only one of the entire series was the tail complete. This series, if undamaged, would certainly average more than 130. I feel sure that specimens from the plateaus and mountains of Szechwan will prove to have quite as high a count and am therefore putting all the Szechwan references in the synonymy of *montanus*.

Stejneger's *oshimai* is, without any doubt, the Formosan form of *dhumnades*, and has a still higher subcaudal count (average for males 148, females 140) than *montanus* (Maki, 1931, p. 71). It also has more scale rows keeled than either mainland form, and differs further in the frequent presence of keels

on the neck. Table XXV records the presence or absence of carination and the number of rows keeled at three points on each of nine (Formosan) specimens examined by me in the Naturhistorisches Museum, Vienna.

TABLE XXV. KEELING OF SCALES OF *ZAOCYS DHUMNADES OSHIMAI*

Formosan Locality	Number of Rows Keeled		
	Head-length Posterior to Head	Midbody	Head-length Anterior to Vent
Kosempo.....	none keeled	6	6
Taihorin.....	none keeled	6	7
Kankao.....	none keeled	8	9
Taihorin.....	1	6	6
Kosempo.....	2	6	6
Taihorin.....	3	8	8
Koshun or Kosempo...	3	10	12
Koshun or Kosempo...	4	8	12
Koshun.....	4	14	13

These notes on *oshimai* are recorded merely to prove the subspecific distinctness of *oshimai* and *montanus*.

54. *Zaocys nigromarginatus* (Blyth)

Figure 49, a

*Coluber nigromarginatus* Blyth, 1854, Journ. Asiat. Soc. Bengal, XXIII, p. 290 (type locality, vicinity of Darjeeling, Bengal).

*Coryphodon carinatus* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 112 (type localities, Borneo, Chusan, Khasya, Sikkim, Afghanistan; later restricted by Guenther to Borneo) (part: Khasya and Sikkim).

*Zaocys nigromarginatus* Guenther, 1864, Rept. Brit. India, p. 257, Pl. XXII (Nepal; Sikkim; Khasya).—Annan-dale, 1911, Rec. Ind. Mus., VI, p. 217 (Lushuiho, Szechwan).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 522 (part: Tengyueh, Yunnan).

*Zaocys dhumnades* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 119 (part: northeastern Yunnan).

*Description*.—This species is strikingly like *dhumnades montanus* and, save for subcaudal count, *dhumnades dhumnades* in scale characters and habitus, a fact that has caused many workers to confuse the two species. They differ markedly in pattern as follows:

1. *Z. nigromarginatus* is striped only on the tail and posterior half to two thirds of its body, while typical *dhumnades* is striped throughout.

2. In *dhumnades*, the stripes grow very obscure with age and this obscurity is always much more marked posteriorly where many adults become uniformly black. The stripes in *nigromarginatus* seem to be a great deal more persistent and never entirely disappear.

3. The scales of the region anterior to the stripes of *nigromarginatus* are conspicuously bordered with black. This condition, while more or less present in *dhumnades*, is largely obscured by the stripes and anything but conspicuous.

4. The stripes of *nigromarginatus* are of uniform intensity and have very clean-cut, straight edges, thus appearing to have been painted on in total disregard of the scale rows; those of *dhumnades* are less intense and their edges conform rather closely to the borders of the scales.

The whole question of color is greatly obscured by the tendency, already referred to, of *dhumnades* and *nigromarginatus*, especially the former, to become black with maturity. In fact, even small examples of *dhumnades montanus* may be entirely black. However, this tendency does not always show itself in *nigromarginatus* if we may judge by the following description of a Shillong specimen about 2000 mm. long (Wall, 1908, p. 325):

It is difficult to realise from museum specimens the extreme beauty and brilliancy of colouring of many snakes in life, and this forcibly applies in the present instance. My specimen was a bright green of so soft a hue that the skin looked like velvet. This merged into yellowish-green anteriorly, and yellow posteriorly, the latter merging into a rich black on the tail. The black margins to the scales served to enhance the beauty of the dorsal green. The head was olive-brown with a bright yellow patch low on the temporal region. The chin and throat were white, sparsely speckled at first, more heavily later, with light cerulean blue, which merged to blue-green, then pale greenish, and, finally, yellow in the length of the snake. Some grey speckling was seen beneath the tail.

Two males from Tengyueh in the American Museum have ventrals 197 and 198, subcaudals 116+ and 131, respectively. They have 6 and 4 middorsal rows keeled at midbody, and the scale formula is 16-14 in both.

Guenther (1864, p. 257) mentions a specimen 2438 mm. long.

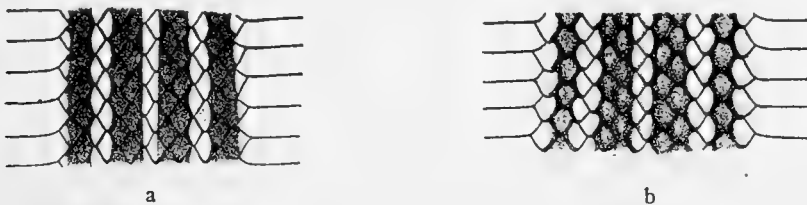


FIG. 49. *Zaocys nigromarginatus*.  $\times 3$ . a. Juvenile pattern two head-lengths before vent. A.M.N.H. No. 17707 from Yunnanfu.

*Zaocys dhumnades dhumnades*.  $\times 5$ . b. Juvenile pattern two head-lengths before vent. A.M.N.H. No. 23540 from Ningkwo, Anhwei.

The original description follows:

Nearly affined to *C. radiatus*, Schlegel, but attaining the size of *C. mucosus*, (L., v. *Blumenbachii*, Merrem): our largest specimen measuring  $7\frac{3}{4}$  ft. long, of which the tail is 2 ft. 1 in.

Colour a bright pea-green (changing in spirit to blue), paler below, each scale of the upper-parts margined with black. Upon the shields of the crown the black margins are extremely slight though present, and they gradually increase in breadth posteriorly until about the middle of the entire length, when the two colours resolve into four black alternating with three narrower blue streaks which are continued to the end of the tail. Eye larger than in *C. mucosus*, much larger than in *C. radiatus*. One large superior and one small inferior præocular plate; and a single frænal, the latter as in *C. radiatus*, to which the present species bears a near approximation in the details of its structure. Sixteen rows of scales, the four median slightly carinated. Scutæ 192-4; scutellæ 126-132 pairs.

The hemipenis of *nigromarginatus* has fewer spines than that of *dhumnades*. In other respects, this organ is alike in the two species. These points require checking because I have only one specimen of *nigromarginatus* suitable for comparison.

*Distribution*.—In China, this species ranges into southern Szechwan and across much of Yunnan. It has been secured from the following localities:

Szechwan: Ningyuan; Lushuiho.

Yunnan: Tengyueh; 20 miles north of Yunnanfu; Yunnanfu.

Distributed from Nepal eastward through Sikkim, Assam and northern Burma, into China (Wall, 1925, p. 812).

*Habits and Habitat*.—*Z. nigromarginatus* is, apparently, a snake of high altitudes, ascending to 7100 feet in the Himalayas (Guenther, 1860, p. 167).

*Material examined*.—I have seen the following Chinese specimens: 2 from Tengyueh, and 1 from 20 miles north of Yunnanfu, in the American Museum; 1 from Yunnanfu, in the British Museum; 2 from Ningyuan, in the U. S. National Museum; and 1 from Yunnanfu, in the Museum of Comparative Zoölogy.

*Remarks*.—I am certain that this snake is perfectly distinct from *dhumnades* and has no place in the fauna of eastern China or Formosa, or, in fact, any part of China save Yunnan and extreme southern Szechwan. Its distribution is strikingly like that of many other species and I am not at all puzzled to find it at Ningyuan but *dhumnades* at Süchow. There is, moreover, no evidence to support the view that *nigromarginatus* is a subspecies of *dhumnades*.

In losing the posterior part of the pattern in advance of the anterior part, *dhumnades* accomplishes during each ontogeny the exact reverse of what *nigromarginatus* has already accomplished in phylogeny. These facts may be taken as additional evidence of the distinctness of the two species.

#### Genus *Ptyas* Fitzinger

*Ptyas* Fitzinger, 1843, Syst. Rept., p. 26 (type, *Coluber blumenbachii* = *P. mucosus*).

This genus is comprised only of the two species treated below, and its

validity is often questioned, *P. mucosus* and *korros* being assigned to *Zamenis* = *Coluber*. For the present, I see no need to disturb the position of these species as generically distinct since their divided loreals are very unusual and they have other characters in common.

## OBVIOUS RECOGNITION CHARACTERS

Size large; loreal compound.

## KEY FOR IDENTIFICATION OF SPECIES

- I. Scales in 21 or 19 rows on the neck, 17 at midbody and 14 before the vent..... *mucosus*, p. 220
- II. Scales in 17 or 15 rows on the neck, 15 or 13 at midbody and 11 before the vent..... *korros*, p. 217

55. *Ptyas korros* (Schlegel)

*Coluber korros* Schlegel, 1837, Phys. Serp., II, p. 139 (type locality, Java).

*Coryphodon korros* Müller, 1878, Verh. Naturf. Ges. Basel, p. 601 (Lilong, Kwangtung).

*Ptyas korros* Anderson, 1879, Zool. Res. W. Yunnan, p. 816 (Chanta and Husa valleys, Yunnan).

*Zamenis korros* Boulenger, 1890, Fauna Brit. India, p. 324.

*Ptyas korros chinensis* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 320 (type locality, Yaoshan, Kwangsi).

*Ptyas korros indicus* Mell, 1931, Lingnan Sci. Journ., VIII, p. 208 (type locality, southwestern Yunnan).

*Description*.—Loreals 2 or 3; upper labials 8, rarely 9, very rarely 7; preoculars 2, very rarely united; postoculars 2, very rarely 3; anterior temporals 2, very rarely 3; posterior temporals 2, very rarely 3 (temporals rarely irregular); scales smooth or with a few middorsal rows keeled posteriorly, in 15 rows on the neck, 13, very rarely 15, at midbody, and 11 before the vent; ventrals in nine males 163-169, in sixteen females 159-168; subcaudals in eight males 113-120, in eleven females 113-124; length of four largest males 862+400, 820+?, 811+420 and 798+403, females 818+420, 802+410, 775+? and 750+397 mm. Color uniform brown above, each scale with or without a slightly darkened median longitudinal portion or an inconspicuous, black apical spot; belly uniform yellowish or milky white; young with irregular, narrow white cross-bands anteriorly which may be discernible to maturity. (Description based on ten specimens from Futsing Hsien, ten from Yenping, one from Chungan Hsien, three from Hokow and one without more definite locality than Fukien.)

Table XXVI shows the ventral and subcaudal counts for additional series from China and Formosa, the figures in parentheses indicating the number of specimens on which the counts are based.

All the available information, including that given herewith, proves that *korros* is very remarkable in lacking the usual sexual dimorphism in ventral and subcaudal counts as well as in size and proportionate tail length. In fact, the males appear to exceed the females in length of body.

American Museum No. 27817, a male from Hainan, measures 1112+567

TABLE XXVI. VENTRAL AND SUBCAUDAL COUNTS OF *PTYAS KORROS* FROM CHINA AND FORMOSA

Locality	Sex	Ventrals	Subcaudals	Reference
Hainan.....	♂	(9)165-175	(7)128-141	Schmidt, 1927, p. 442
Yaoshan.....	♂	(8)164-172	(8)118-132	Fan, 1931, p. 79
Yaoshan.....	♀	(5)164-170	(3)124-130	Fan, 1931, p. 79
Formosa.....	♂ + ♀	(6)163-170	(3)125-129	Maki, 1931, p. 76
Yuankiang.....	♂	173	121+	Pope, 1929, p. 420
Yuankiang.....	♀	166	128	Pope, 1929, p. 420

mm., but Flower (1899, p. 666) records one from Siam 1780 mm. in total length.

The hemipenis has been figured by Cope (1895, Pl. xvi, fig. 5) and described and figured by Brongersma and Wehlburg (1933, p. 3, Pl. 1). It does not closely resemble that of *mucosus*.

*Distribution*.—*P. korros* is known from the following Chinese localities:

Chekiang: Tunglu; Taichow.

Kiangsi: Hokow; Kiukiang.

Fukien: Chungan Hsien; Yenping; Foochow; Futsing Hsien; Amoy; southern Fukien.

Kwangtung: Wanszushan; Canton; Lilong; mainland opposite Hongkong.

Hainan: Hoihow; Nodoa.

Kwangsi: Yaoshan.

Hunan: Hsikwangshan.

Yunnan: Yuankiang; Chanta and Husa valleys.

Distributed from the Eastern Himalayas and Assam southward through the peninsula of southeastern Asia into the Malay Archipelago.

*Habits and Habitat*.—I found this snake everywhere in northern Fukien save in the high Kuatun mountains. It is common in hills and open plains and plateaus alike. Mell (1922, p. 119) states that it prefers hilly country in Kwangtung where it is found in abundance to an altitude of 800 meters. On Formosa it ascends to 1000 meters (Maki, 1931, p. 75).

I (1929, p. 420) have already reported finding frog remains in seven stomachs of Fukien, Kiangsi and Yunnan specimens and can now add that one Hainan individual had eaten a gecko (*Hemidactylus frenatus*) and a skink, a second a frog (*Rana limnocharis*) and a third an unidentifiable frog. Boulenger (1912, p. 137) states that *korros* feeds on frogs, birds and rats, a statement with which Maki (1931, l.c.) apparently agrees. Its "arboreal tendencies" (Smith, 1914, p. 94, and Wall, 1908, p. 326) may be taken as confirming a love of birds

as food, but more definite records would be satisfying. Smith's generalization that, at Bangkok, *korros* confines itself "chiefly to patches of open brush-wood about the edges of padi-fields" certainly convinces me that there, as in China, frogs probably form its staple diet.

Mell (1922, l.c.) records four clusters of about 9 eggs apiece, measuring 35-37 x 17-19 mm., secured in Kwangtung from May 26 to June 8. He found newly-hatched individuals in early September. Wall and Evans (1900, p. 353) report a female killed in the Rangoon district containing 9 eggs without obvious embryos. The date in this case is June 3. Again, Wall (1909, p. 621) tabulates data on five gravid females from Assam dated from May 13 to June 4, holding 1, 3, 4, 5 and 6 eggs, respectively. Oddly enough, I can find no females with advanced eggs in the American Museum's Chinese series, but, going far afield, it is interesting to know that 9 eggs of this species measuring 41-46 x 22-23.5 mm. were found under stones on August 22 at Garoet, Java, and that young snakes 365 mm. long hatched from these eggs on October 29 (Kopstein, 1930, p. 303, fig. 7).

A large Hainan specimen, when released on a lawn, did not at once assume a definite defensive attitude but annoyance caused it to bite itself viciously. When its line of retreat was repeatedly blocked, it elevated the head, even to two feet above the grass, and darted at the obstructor with open mouth. Mell (1929, p. 252) suggests that this habit of rearing the anterior body straight upward serves to bring into play the ventral yellow which contrasts strongly with the dorsal brown and, together with the open mouth, produces a startling or frightening effect on human opponents.

When seized by the neck, *P. korros*, like *Natrix percarinata*, sometimes thrashes so violently from side to side, and even revolves on its longitudinal axis, that it is by no means easy to hold. I have observed such defensive behavior in relatively few snakes.

*Material examined*.—I have seen the following specimens from China: 1 specimen each from Kiukiang and southern Fukien, in the British Museum; 1 each from Tunglu and Lohsiang, in the Museum of Comparative Zoölogy; 1 from Futsing and 5 from Foochow, in the U. S. National Museum; 9 from Hainan, 10 each from Futsing Hsien and Yenping, 1 from Chungan Hsien, 1 from Fukien, 3 from Hokow and 2 from Yuankiang, in the American Museum.

*Remarks*.—Like *P. mucosus*, this snake has often been referred to the genus *Zamenis*. The remarks made under *mucosus* (p. 223) apply in this case as well.

Mell's subspecies of this snake (see synonymy) do not, in my estimation, warrant recognition. A study of the scale counts for Hainan, Kwangsi, Fukien, Kiangsi and Yunnan given by Schmidt (1927, p. 442), Fan (1931, p. 79) and

me (1929, p. 419) will show at once that the very erratic variations exhibited do not coincide with any logical geographical distribution. Mell's separation of the Hainan from the Kwangtung material is especially untenable.

#### 56. *Ptyas mucosus* (Linnæus)

*Coluber mucosus* Linnæus, 1758, Syst. Nat., ed. 10, p. 226 (type locality, "in Indiis").

*Coryphodon Blumenbachii* Duméril and Bibron, 1854, Erp. Gén., VII, p. 184 (probably China).—Parenti and Picaglia, 1886, Atti Soc. Natural Modena, Mem., (3) V, p. 69 (Amoy) (specific name spelled with single *i*).

*Leptophis trifrenatus* Hallowell, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 503 (type locality, Hongkong).

*Ptyas mucosus* Cope, 1861, Proc. Acad. Nat. Sci. Phila., XII, p. 563.—Anderson, 1879, Zool. Res. W. Yunnan, p. 815 (Tengyueh, Yunnan).

*Zamenis mucosus* Boulenger, 1890, Fauna Brit. India, p. 324.

*Zamenis mucosus* Stanley, 1918, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLIX, p. xiii (Batang, Hsikang).

**Description:**—Lorals 3, occasionally 4, rarely 5; upper labials 8; preoculars 2; postoculars 2; anterior temporals 2; posterior temporals 2 (extra small scales rarely present among temporals); scales in 19 rows on the neck, 17 at midbody and 14 before the vent, only the middorsal rows keeled; ventrals in four males 192-196, in seven females 194-197; subcaudals in two males 111-114, in six females 105-114; length of males 1800+600, 1510+445+, 1330+415 and 1035+263+, females 1630+535, 1570+500, 1550+515, 1360+485, 1325+450, 1250+320+ and 1085+367 mm. Color brown, uniform anteriorly but more or less reticulated or cross-banded posteriorly, due to a variable degree of development of black margins to scales; ventrals and subcaudals usually with conspicuous, black posterior edges; labial sutures black. (Description based on five specimens from Futsing Hsien, three from Yenping, one from Chungan Hsien and two from Hokow.)

Table XXVII shows the ventral and subcaudal counts for additional series from China and Formosa, the figures in parentheses indicating the number of specimens on which the counts are based.

TABLE XXVII. VENTRAL AND SUBCAUDAL COUNTS OF *PTYAS MUCOSUS* FROM CHINA AND FORMOSA

Locality	Sex	Ventrals	Subcaudals	Reference
Hainan.....	♂	(7)194-200	(7)112-118	Schmidt, 1927, p. 442
Hainan.....	♀	(4)193-200	(4)111-118	Schmidt, 1927, p. 442
Lohsiang.....	♂	(4)190-194	(4)111-119	Fan, 1931, p. 78
Lohsiang.....	♀	194	110	Fan, 1931, p. 78
Formosa.....	♂	(3)187-195	(3)105-121	Maki, 1931, p. 74
Formosa.....	♀	(2)197-201	(2)94-109	Maki, 1931, p. 74
Formosa.....	♂ + ♀	(4)190-197	(4)104-117	Maki, 1931, p. 74



*P. mucosus*, like *P. korros*, certainly lacks the usual marked sexual dimorphism in ventral and subcaudal counts, size, and proportionate tail length. Since data on a sufficiently large series from one locality have not been published, it is impossible to draw final conclusions, but the few figures available indicate that the females have scarcely if any more ventrals than the males, while the latter have only a slightly higher average number of subcaudals than the former. Wall (1921, p. 180) is convinced that the males attain a greater length than the females and the dimensions of Chinese specimens support his conviction admirably.

The largest specimen among more than 200 examined by Wall (1921, p. 183) was 2490 mm. long but he records one that measured 3583 mm.

The hemipenis extends to the tenth to eleventh subcaudal plates. It is spinous proximally, flounced distally, the two areas thus characterized being about equal in extent and sharply set off from each other. There are two very large basal spines or hooks followed by about six irregular rows of uniform spines, approximately fifty in number. The spines are thick and each is surmounted by a minute, sharp, thorn-like process. The flounces are well developed with finely serrated edges and are markedly reduced in size at the tip of the organ. The sulcus is not prominent, its lips smooth in the spinous area, flounced in the flounced one. (Description based on a Hainan specimen.)

Wall (1921, p. 180) has given an incomplete description of this hemipenis.

*Distribution*.—This snake has been secured on Formosa and at the following localities in China:

Chekiang: Taichow; Wenchow.

Hupei: Ichang.

Kiangsi: Hokow.

Fukien: Chungan Hsien; Yenping; Ningteh; Foochow; Futsing Hsien; Amoy; southern Fukien.

Kwangtung: Kowloon; Wuyung; Canton region.

Hainan: Hoihow; Kachek; Nodda.

Kwangsi: Yaoshan.

Yunnan: Tengyueh.

Hsikang: Batang.

Guenther (1864, p. 249) and Boettger (1888, p. 134) include Chusan in the range of *mucosus*, both apparently considering Cantor their authority. I am unable to discover any reference to the presence of this snake on Chusan in Cantor's papers.

Distributed from Transcaspia and Afghanistan southward to Ceylon and eastward (skirting the Himalayas) through much of southern China and all of the peninsula of southeastern Asia into the Malay Archipelago.

*Habits and Habitat*.—*P. mucosus* is generally distributed in southeastern

China, apparently showing no marked preference for any special type of habitat. I did not, however, secure it in the mountains about Kuatun and Sanchiang, a point worthy of special notice.

In reference to Mell's (1922, p. 120) implication that this snake does not inhabit the relatively low mountains of northern Kwangtung, the following records of the altitude to which it ascends are of interest:

Formosa: 3281 feet ("1000 meters") (Maki, 1931, p. 73).

Tengyueh: "nearly 5000 feet" (Anderson, 1879, p. 815).

Shan States: 5000 feet (Boulenger, 1893, p. 386).

N. W. Himalayas: 7000 feet (Stoliczka, 1870, p. 185).

Nilgiri Hills and adjacent Wynaad: 3000 to 7000 feet (Wall, 1919, p. 555).

Stanley's (1918, p. xiii) record for Batang indicates that *mucosus* occurs at 9400 feet in Hsikang. Perhaps this record requires confirmation.

Several small toads (*Bufo*) were found in the stomach of a Hokow specimen (Pope, 1929, p. 421), while a frog (*Rana limnocharis*) was dissected from a Hainan example in the American Museum. Smith (1914, p. 94) records an individual from Siam that consumed three toads, while Wall (1926, p. 562) reports one from Burma that had eaten a single toad.

Mell (1922, p. 120) reports a captive Kwangtung example that laid, on June 10, twelve eggs averaging 65 x 29 mm. in size.

A large individual observed by me on Hainan neither bit nor assumed any defensive attitude when teased. It did, however, inflate the throat and blow, meanwhile making wild dashes for freedom. Smith (1914, l.c.) remarks that, at Bangkok, he found *mucosus* "a wild and excitable creature, seeking refuge in rapid flight when encountered, but defending itself vigorously if attacked," but does not describe the method of defense. Flower (1899, p. 667), however, definitely states that it is fierce and bites hard, and adds that it rears like a cobra, dilating its neck on the lower side so that the ventral shields are thrust out and become acutely keeled while the skin of the sides of the neck is greatly stretched. The noise made by it when angry is described as a "roaring, something like the deep growling of a big dog."

The more pertinent points in Wall's (1906, pp. 259-273, and 1921, pp. 172-190) excellent accounts of this snake are tabulated below:

1. It occurs in a great variety of habitats (pp. 173-174).
2. It is naturally diurnal but is sometimes forced into nocturnal habits by man whose habitations it often frequents (pp. 174 and 177).
3. It shows partiality for the vicinity of water and also climbs well (p. 175).
4. Frogs and toads form its staple diet but it has been known to consume rats, bats, birds, lizards (including geckos, skinks and agamids), other snakes and even a turtle (*Trionyx*) (pp. 177-179).
5. It lays from 9 to 14 white eggs (p. 182).
6. The female coils about her eggs (p. 181).

7. The breeding season varies considerably with geographical location and climate (pp. 181-182).

8. Hatchlings escape from the egg by means of an egg-tooth, measure from 361 to 472 mm., and appear to double their length during the first year of life and again during the second, while at the end of the third they are large snakes 5 to 5.5 feet long (p. 183).

9. It is eaten by man, serpent eagles, mongooses, other snakes (*Naja* and *Bungarus*) and large frogs (hatchlings by *Rana tigerina*) (p. 184).

*Material examined*:—I have seen the following Chinese specimens: 1 each from Kowloon and southern Fukien, in the British Museum; 1 from Ichang, in the Museum of Comparative Zoölogy; 11 from Hainan, 5 from Futsing Hsien, 3 from Yenping, 1 from Chungan Hsien and 2 from Hokow, in the American Museum.

*Remarks*:—Wall (1914, p. 168) has argued that *mucosus* really belongs to *Zaocys* (which name, however, as pointed out by him in 1923, p. 617, is antedated by *Ptyas*) because it has an even scale count posteriorly, while species of *Zaocys* have such a count throughout their entire length save on the neck. He made much of the fact that these even counts were acquired in the same way, namely, by the loss of the middorsal row. This point is not, however, so important because even scale row counts are probably always acquired in this way. The presence of a short, extra row on the neck of *Zaocys* species may be regarded as a purely vestigial condition of no great importance and perhaps of long standing.

#### Genus *Coluber* Linnæus

This genus is widely distributed in North America, Europe and Asia and also occurs in Africa and the Malay Archipelago. Only a single species (*C. dipsas*) is found in the last named region.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

A conspicuous black-edged, middorsal, yellow stripe extending from between the eyes onto the tail; belly uniform yellowish; habitus attenuate.

#### 57. *Coluber spinalis* (Peters)

##### Plate IX, A, B and C

*Masticophis spinalis* Peters, Feb., 1866, Monatsber. Akad. Wiss. Berlin, p. 91 (type locality, "Mexico").

*Zamenis Bocourti* Jan, 1866, Nouv. Arch. Mus. Hist. Nat. Paris, II, Bull., p. 6 (type locality, Siam).

*Zamenis cataphorantus* Jan and Sordelli, 1867, Icon. Ophid., Livr. 23, Pl. II, fig. 2 (type locality, Bangkok, Siam).

*Zamenis spinalis* Guenther, 1872, Ann. Mag. Nat. Hist., (4) IX, p. 22 (China or Japan).

*Coluber spinalis* Slevin, 1925, Proc. Calif. Acad. Sci., (4) XIV, p. 98 (Korea).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 523, Pl. xxviii (26 miles south of Hsinglungshan, Hopei; Maitaichao, Suiyuan; and Chintzu and Sohuang, Shansi).—Pope, 1929, LVIII, p. 418 (Kholobolchi Nor, Outer Mongolia; Mongolia; Western Hills, Hopei; and Tsinan region, Shantung).

*Description*:—Upper labials 8, very rarely 7; preoculars 2, very rarely 1; postoculars 2; anterior temporals 2; posterior temporals small and scale-like,

3, occasionally 2; scales smooth, in 17 rows on the neck and at midbody, 15 before the vent; ventrals in males 186-194, females 202-206; subcaudals in five males 92-99, in two females 90-91; males from snout to vent 570, 557, 539, 518, 467 and 396, females 694, 632 and 613 mm. (Description based on nine specimens from the Tsinan region.)

Table XXVIII records additional data on material in the American Museum, the figures in parentheses indicating the number of specimens involved.

TABLE XXVIII. VENTRAL AND SUBCAUDAL COUNTS AND DIMENSIONS OF *COLUBER SPINALIS* FROM CHINA AND MONGOLIA

<i>Locality</i>	<i>Sex</i>	<i>Ventrals</i>	<i>Subcaudals</i>	<i>Length in Millimeters from Snout to Vent</i>	<i>Amer. Mus. No.</i>
Tukhum.....	♀	201	98	400	31844
Kholobolchi Nor...	♀	207	99	4610	31843
Chintzu.....	♂	189	92	375	28257
Sohuang.....	♂	195	101	572	28284
Western Hills.....	♂	188	91	500	29476
Western Hills.....	♀	(2)205	(2)94-103	755 and 483	29477-78
26 miles south of Hsinglungshan...	♂	189	96	522	21470

In spite of Wall's statement (1903, p. 91) 8, not 9, is the normal number of upper labials. None of the twenty-one specimens collected by the Central Asiatic Expeditions has 9, while only a single individual has 7 and that but on one side. Numerous published records offer additional confirmation.

A translation of the original description, based on the type specimen, follows:

Posterior maxillary tooth ungrooved, but longer than the preceding teeth which are almost uniform in length. Head elongated, twice as long as broad, with projecting, rounded snout. Prefrontals broader than long; not longer than the internasals. Nostril between the upper portions of the two nasals. Frenal trapezoidal, longer than broad. Two preoculars, of which the large upper one is not in contact with the frontal, the lower as usual is small, situated below, between the 3rd and 4th upper labials. The frontal is very long, anteriorly broad and very obtuse, shallowly concave on the sides, posteriorly rounded and acute. The parietals are scarcely longer than the frontal and rounded posteriorly. The supraoculars are narrower in front than behind, where they are much broader than the frontal in the same region. Two postoculars. Temporals on the left 2 + 2 + 3, on the right 1 + 2 + 3, as here the first upper scale is fused with the parietal. Eight supralabials, of which the 4th and 5th enter the eye; 10 infralabials, the first of which meets that of the opposite side behind the

mental; the 5th is the largest. Two pairs of long submentals, which are in contact with five infralabials, and of which the posterior are somewhat longer. Body very long and slender, with 17 longitudinal rows of smooth scales, of which those of the back show two apical pits; the scales of the lowermost row are twice as broad as those of the middorsal row. The lateral scales close to the vent are considerably smaller than the others. Ventrals 203, a divided anal and 96 pairs of subcaudals.

The dorsal surface is olive-greenish brown. A beautiful, black-bordered, yellow, longitudinal band begins near the anterior end of the frontal and extends along the middle of the back, occupying the middle scale row and half of the adjacent row on each side, to near the end of the tail. An indistinct, yellow cross-band on the posterior end of the prefrontals; the pre- and postoculars, an indistinct, narrow, longitudinal band on the temporals, the greater part of the supralabials, and the ventral surface of the animal are yellow. An irregular, jagged band on the upper portion of the supralabials, which is interrupted on the 5th supralabial and appears again narrower on the posterior part of the neck, likewise a spot on the anterior side of the ventrals at the lateral angle, are black. An indistinct, blackish line extends over the end of the ventrals and the part of the scales in the lowermost row lying between them; the latter are lighter in the center, so that above the blackish a lighter, longitudinal line arises, parallel to which similar lines appear on the sides of the body and the tail. Total length 835 mm.; length of head 21 mm.; width of head 10 mm.; length of tail 220 mm.; thickness of body 10.5 mm.

The hemipenis extends to the tenth to eleventh subcaudal plates. It is spinous proximally, calyculate distally, the spinous area being slightly more extensive than the calyculate one. Two pairs of spines or hooks are present a short distance distal to the base of the organ, the larger pair slightly proximal to, and separated from the sulcus by, the smaller. Numerous spines arise immediately distal to the latter. These are nearly uniform in size, curved and pointed. The line of demarcation between spines and calyces extends straight across the organ and is abrupt but inconspicuous. The calyces have very shallowly scalloped, soft edges and are uniform save for a gradual reduction in size distally. They do not extend quite as far as the sulcus, which is conspicuous throughout. Its raised lips bear small spines in the spinous area but are scarcely encroached upon by the calyces in the calyculate one. (Description based on a specimen from the Tsinan region.)

Ortenburger (1928, p. 173) has briefly described the hemipenis of *spinalis*, stating that it has 89-95 spines in 5-6 rows and 12-13 rows of calyces.

*Distribution*.—*C. spinalis* is known from the following localities:

Shantung: Tsingtao; Chefoo; Weihsien; Tsinan and region.

Honan: Wuan.

Kansu: Taipai.

Suiyuan: Maitaichao; Tukhum.

Shansi: Chintzu; Taiku; Sohuang.

Hopei: 26 miles south of Hsinglungshan; Chinwangtao; Peiping; Western Hills; Tsangchow.

Jehol: "Balihandién"; Tungkiayingtze.

Korea: See Maki, 1931, p. 77.

Manchuria: Chaoyangchen region (Sowerby, 1930, p. 18). Also see Emelianov, 1929, p. 44, and Mori, 1927, p. 142.

Outer Mongolia: Kholobolchi Nor. Also see Zarevskij, 1930, p. 215.

Bedriaga (1912, p. 695) has given records for the Alashan-Ordos region. I am unable to identify with certainty Wall's (1903, l.c.) "Huangtsun."

In view of the fact that this snake is probably transported artificially about China (Emelianov, 1929, p. 45), I prefer to await confirmation of its occurrence at Nanking (Chang and Fang, 1931, p. 260) and Chengtu (Vogt, 1924, p. 339). Boulenger's (1893, p. 394) Hainan record has long since been discredited (Stejneger, 1907, p. 318). The early records for Siam given in the synonymy are certainly also erroneous.

*Habits and Habitat*.—*C. spinalis* frequents various types of country. It seems to be partial to the vicinity of streams but may also be encountered far from water in very dry and barren regions. In Manchuria, it even frequents forests (Sowerby, 1912, p. 110, and 1930, l.c.). It ascends to an altitude of at least 5119 feet in Kansu (Taipai) (Clark and Sowerby, 1912, pp. 76 and 237), while numerous records affirm its abundance at low elevations.

This slender, active snake is very docile and quite harmless. It has been reported to feed on geckos (*Gekko*) by Wall (1903, l.c.) and Jacot (1923, p. 260) and on a species of *Eremias* by the latter, while two specimens in the American Museum (Nos. 21470 and 23921) contain lizard remains, also *Eremias*, while a lizard's tail was found in a third (No. 4974).

The specimen from Kholobolchi Nor was taken in early July and contains 9 well-developed eggs with embryos still in the first stages of development. One egg measures 38 x 11 mm. This species is certainly oviparous.

*Material examined*.—I have seen the following specimens: 3 from the Western Hills, 1 from twenty-six miles south of Hsinglungshan, 2 from Maitaichao, 2 each from Chintzu and Sohuang, 9 from the Tsinan region, 1 each from Kholobolchi Nor and Tukhum, and 1 without data, in the American Museum; 1 from Taipai, and 1 without data, in the U. S. National Museum.

*Remarks*.—Ortenburger (1928, l.c.) has discussed the relationship of *spinalis* to the forms included by him in the genus *Masticophis* on the one hand, and to those he grouped together generically as *Coluber* on the other. He fails to make the species in question fit into either of these two genera but concedes "that *spinalis* is probably the nearest exotic relative of the genus *Coluber*." In view of his conclusion and pending a more detailed study of the Old World aspect of the problem presented by the confusing array of snakes variously placed under *Coluber*, *Zamenis*, *Masticophis*, etc., I consider it wise to refer *spinalis* to *Coluber* just as Slevin did in 1925 (p. 98).

Genus *Elaphe* Fitzinger

*Elaphe* Fitzinger, 1832, in Wagler, Descr. Icon. Amphib., pt. 3, text to Pl. xxvii (Col.) (type, *E. parreysii* = *quatuor-lineata*).

*Phyllophis* Guenther, 1864, Rept. Brit. India, p. 295 (type, *P. carinata*).

*Spaniopholis* Mocquard, 1897, Bull. Mus. Hist. Nat., Paris, III, p. 216 (type, *S. souliei*).

*Rhadinophis* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 140 (type, *R. melli*).

The numerous snakes commonly referred to this genus occur in North America, Europe, Asia and the Malay Archipelago. Although without doubt the species of *Elaphe* as generally understood are too varied to be included in a single genus, the problem of properly dividing them is a major task because there are apparently no sharp lines of demarcation. I believe, however, that a collation of hemipenes will give results. There is certainly no objection to recognizing the genus *Gonyosoma* Wagler (type, *G. viride* = *Coluber oxycephalus* Boie) and placing *frenata* and *prasina* in it. I have not done so simply because of the generally conservative treatment of genera followed in this work. In the case of a genus as large as *Elaphe*, it may be just as well, or even best, to leave the splitting off of small groups of species to a future reviser who, one hopes, will clear the matter up once and for all.

*Elaphe leonardi* Wall is not known from China but has been repeatedly collected at Sinlum Kaba, Burma, its type locality. Very recently Angel and Bourret (1933, p. 134) have recorded a snake from Chapa, northern Tongking, as *Elaphe porphyracea leonardi*, stating briefly that it has a slightly different pattern and larger rostral than *leonardi* and differs further from that form in possessing weak keels and a longer internasal than prefrontal suture. This record may be considered evidence of the occurrence of *leonardi* in Tongking, but by no stretch of the imagination can this species be regarded as a form of *porphyracea*. In fact, *porphyracea* and *leonardi* are not even closely allied as a comparison of their hemipenes will show. Angel was undoubtedly misled by Wall's statement following the original description of *leonardi*.

A specimen of *Elaphe cantoris* Boulenger in the British Museum credited to Wall is labeled Fort Hertz, Putao District, Burma, but Wall himself (1923, p. 621) questions the presence of this snake in Burma. Some confusion evidently exists here. This species has not been recorded from China.

The following useless or erroneous records can best be disposed of here:

Guenther (1864, p. 244) and Jan and Sordelli (1867, Livr. 21, Pl. v, fig. 1) record *Elaphe melanurus* from China, but Smith (1916, p. 160) has shown that the northern extremity of the range of this species falls far south of China.

David (1873, p. 228) and Werner (1903, p. 357) recorded *Elaphe quadri-virgata* (Boie) from China but there is no good proof that this species actually occurs there. David's record is not based on concrete evidence, while Werner at the same time recorded two other forms neither of which has since been

unquestionably secured in Chinese territory. Stejneger (1907, p. 326) has already remarked on these records.

Werner's (1903, pp. 356 and 357) undoubtedly erroneous Chinese records of *Elaphe climacophora* (Boie) and *E. conspicillata* (Boie) are those referred to in the preceding item. Oddly enough, *E. climacophora* has since been reported for China (Stanley, 1914, p. 28, and Holtzinger-Tenever, 1919, p. 91) but these records are certainly open to doubt and probably belong in the synonymy of well-known Chinese forms.

*Coryphodon Arnali* David, 1873, p. 227, a nomen nudum, evidently was applied to some large Szechwan *Elaphe*.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Dorsum uniform bright green with or without indistinct, lateral, oblique, black lines, or, if not green (juvenile *frenata*), loreal absent; complete scale formula 19-17-15
  - A. Loreal present. . . . . *prasina*, p. 260
  - B. Loreal absent. . . . . *frenata*, p. 244
- II. Dorsum not bright green; loreal present (small, rarely absent, in *mandarinus*); scales in 17 or more rows just before vent
  - A. Scales in 19 or 21 rows at and anterior to midbody, 17 just before vent
    1. Scales smooth; ventrals fewer than 220
      - a. Scales in 19 rows at and anterior to midbody; belly immaculate. . . . . *porphyracea*, p. 253
      - b. Scales in 21 rows at and anterior to midbody; belly conspicuously spotted with black. . . . . *rufodorsata*, p. 263
    2. Scales keeled; ventrals more than 220
      - a. Anal entire; eight or nine upper labials. . . . . *radiata*, p. 261
      - b. Anal divided; seven upper labials. . . . . *perlacea*, p. 251
  - B. Scales in more than 21 rows either at or anterior to midbody
    1. Scales smooth; no subpreocular; dorsum gray, gaudily adorned with numerous, rhomboidal saddles each consisting of a yellow center broadly bordered with black which is in turn narrowly margined with yellow. . . . . *mandarinus*, p. 246
    2. Scales keeled, or, if smooth, a subpreocular present; dorsum without conspicuous yellow and black rhomboidal saddles
      - a. One or two outer scale rows smooth at midbody, the others strongly keeled
        - (1) More than 200 ventrals. . . . . *carinata*, p. 233
        - (2) Fewer than 200 ventrals. . . . . *davidi*, p. 238



- b. More than two outer scale rows smooth at midbody, keels, when present, not strongly developed
- (1) Tail with four black and four white longitudinal stripes, one white one middorsal, another mid-ventral. . . . . *laeniurus*, p. 271
- (2) Tail without four black and four white stripes
- a'. More than 250 ventrals. . . . . *moellendorffi*, p. 250
- b'. Fewer than 250 ventrals
- a''. Pattern complex in young, rapidly fading with maturity; entirely or almost entirely disappearing anteriorly and reduced to indistinct, double, black blotches posteriorly; postocular stripe solid black in young. . . . . *schrenckii anomala*, p. 266
- b''. Pattern complex, not changing noticeably with age, always uniform throughout length of body; postocular stripe olive gray with black margins
- (a) Lower labials eight to ten, rarely eleven; both branches of posterior head pattern extending caudad a short distance along neck as two parallel, black-edged stripes; a double row of circular spots along middle of back often connected to form a dumb-bell pattern; maxillary teeth 18-20. . . . . *bimaculata*, p. 229
- (b) Lower labials eleven to thirteen, very rarely ten; posterior head pattern ending abruptly on the occiput as two broad, divergent, black-edged spots; middle of back with numerous, narrow, black cross-bands never more than remotely suggesting a dumb-bell pattern; maxillary teeth 15-17. . . . . *dione*, p. 240

58. *Elaphe bimaculata* Schmidt

Figure 50

*Coluber dione* Boulenger, 1894, Cat. Snakes Brit. Mus., II, p. 44 (part: specimens "q," "r," "s" and "t").—Holtzinger-Tenever, 1919, Archiv. Naturg., LXXXV, Abt. A, Heft 11, p. 91 (part: Chinkiang, Kiangsu).  
*Elaphis dione* Guenther, 1888, Ann. Mag. Nat. Hist., (6) I, p. 170 (Lushan, Kiangsi) (not of Pallas, 1773).  
*Elaphe bimaculata* Schmidt, 1925, Amer. Mus. Novitates, No. 175, p. 3 (type locality, Ningkwo, Anhwei); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 531, fig. 17 (amplified description of type).—Chang and Fang, 1931, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VII, p. 273, fig. 12 (Nanking).

*Description*.—Upper labials 8, 4th and 5th entering orbit; lower labials

10; preoculars 2; postoculars 2; anterior temporals 2; posterior temporals 3; scales smooth or feebly keeled posteriorly, 23-25-23-21 and 23-25-23-21-19; ventrals in male 188, female 207; subcaudals in male 73, female 67. (Description based on the two paratypes, both from the type locality.)

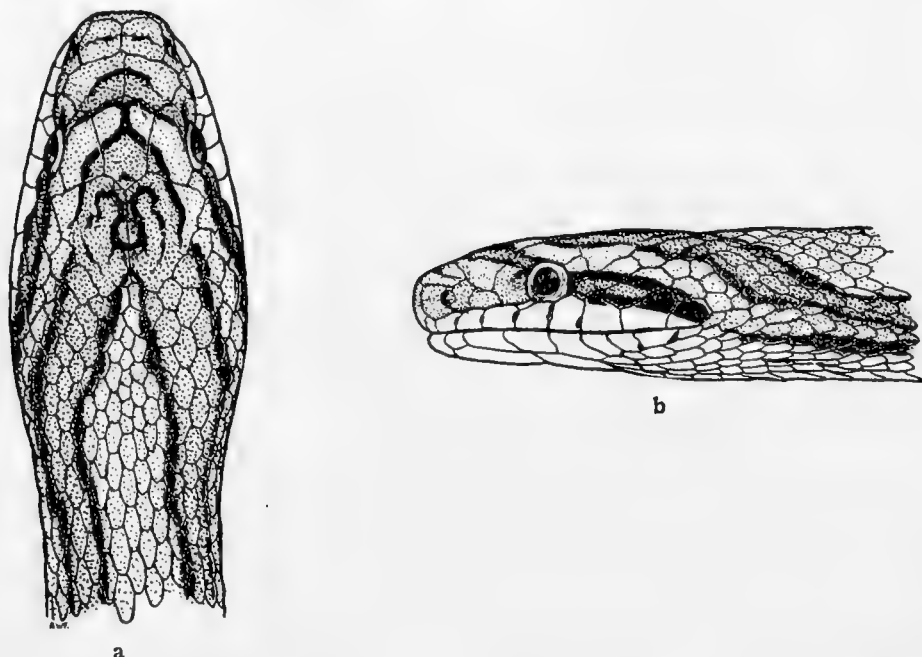


FIG. 50. *Elaphe bimaculata*. Type.  $\times \frac{2}{3}$ . a. Dorsal view of head. b. Lateral view of head.

Table XXIX includes counts of all the additional specimens on record that without doubt represent the present form.

American Museum No. 50802 measures 720 mm. from snout to vent.

Schmidt's amplified description of the type specimen, a female, follows:

Rostral broader than high, visible from above; internasals a little broader than long, their suture more than half the length of the prefrontal suture; prefrontals broadly in contact with the supraoculars; frontal as long as its distance from the snout, shorter than the parietals, much broader in front than behind; nostril between two nasals; loreal small, longer than high; two preoculars, of which the lower is a subpreocular; two postoculars; temporals 2-3; upper labials 8, the fourth and fifth entering the eye; lower labials 9-10; anterior chin-shields longer than the posterior; dorsal scales 25-23-21-19, the first reduction occurring behind the middle of the body; dorsal scales smooth anteriorly, feebly keeled posteriorly; ventral plates 200; subcaudals 74.

Brownish gray above, with transverse darker dumb-bell-shaped markings, sharply outlined with black. These in some places are separated into a pair of spots, and posteriorly they become indistinct; a series of lateral spots alternate with the dorsal series, also outlined with black; a light mid-dorsal line, with less distinct lateral lines, appear on the posterior part of the body, and these become sharply defined on the tail; venter gray with numerous small

darker maculations. Head markings sharply defined; a faint black line from eye to eye crossing on the internasals; a pair of black lines from eye to eye on the prefrontals and anterior border of the frontal; a postocular black band to the angle of the mouth, enclosing a brown area next the eye; head and neck with a closed, black-margined figure which has its apex on the frontal and extends backward to about the fifteenth ventral, enclosing dark maculations

TABLE XXIX. LEPIDOSIS OF *ELAPHE BIMACULATA*

<i>Locality</i>	<i>Sex</i>	<i>Scale Rows</i>	<i>Ventrals</i>	<i>Sub-caudals</i>	<i>Lower Labials</i>	<i>Material or Reference</i>
Wuchang.....	♀	23-23-19	205		10-10	Amer. Mus. No. 50802
Wuchang.....	♂	23-25-19	188	77	10-10	Amer. Mus. No. 50800
Hankow region....	♀	23-25-21	196	67		specimen in Naturhistorisches Museum, Vienna
Hangchow.....	♀	23-25-19	207	69	10-10	U. S. Nat. Mus. No. 82821
"Chen Lang Kuan, Gan King".....	♀	23-25-19	209	64	11-11	Boulenger, 1894, p. 45, specimen "q"
Lushan.....	♀	23-26-21	202	68	10-11	Boulenger, 1894, p. 45, specimen "r"
Lushan.....	♂	23-23-19	187	76	10-10	Boulenger, 1894, p. 45, specimen "s"
(see below).....	♀	23-25-21	204		10-10	Boulenger, 1894, p. 45, specimen "t"
Nanking.....	♂	23-25-19	191	78	8-9	Chang and Fang, 1931, p. 273
Nanking.....	?		197	66		Chang and Fang, 1931, p. 273
Nanking.....	?		204	73		Chang and Fang, 1931, p. 273

on the parietals; the neck marking evidently consists of two or three confluent dorso-lateral spots; lateral spots on the neck similarly united into a line. The total length is 770 mm., of which the tail occupies 154 mm., or .20 of the total.

Within their black margins, the dumb-bell markings are light dull red, a point not brought out in the above description.

The hemipenis extends to the sixteenth subcaudal plate. It is spinous proximally, calyculate distally, the calyculate area being half again as extensive

as the spinous one. The spines are slender, sharp and numerous, and, although the first few are small, their maximum size is rapidly attained. Proximal to the true spinous area, the organ is beset with minute spines. The line of demarcation between spines and calyces is neither conspicuous nor very abrupt, the first row of calyces having rather spine-like scallops. The calyces in general are uniform in size, and shallowly scalloped, all but the most distal scallops having spinous tips. At the very extremity of the organ, the calyces tend to break up into papilla-like structures. Two narrow, parallel, longitudinal regions of maximum development of both spines and calyces are evident, one adjacent to the sulcus on one of its sides, the other on the opposite side of the sulcus and slightly removed from it. The calyces do not extend quite as far distally between these two areas of maximum development as elsewhere. The sulcus is conspicuous throughout. Its lips bear a few small spines in the spinous area, while they are calyculate in the calyculate one. (Description based on one of the paratypes.)

*Distribution*.—*Elaphe bimaculata* is known with absolute certainty from the following localities:

Kiangsu: Nanking.

Chekiang: Hangchow.

Anhwei: Ningkwo.

Kiangsi: Lushan.

Hupei: Hankow region (including Wuchang).

"Chen Lang Kuan, Gan King" (Boulenger, 1894, p. 45).

There is little reason to doubt that the following records of "*dione*" belong here:

Chinkiang, Kiangsu—Holtzinger-Tenever, 1919, p. 91.

Chinkiang, Kiangsu—Stanley, 1914, p. 28.

Chuchow, Anhwei—Stanley, 1916, p. xiii.

Kiukiang, Kiangsi—Kreyenberg, 1910, p. 543.

The first of these is accompanied by data and has therefore been included in the synonymy.

Boulenger's (1894, l.c.) specimen "t" is erroneously reported from Hoihow (Stejneger, 1907, p. 318).

Wall (1903, p. 91), Stejneger (1907, p. 317) and Gee (1919, p. 184) have all probably confused *bimaculata* with *dione* in giving the latter's range in central China, but their records are not based on new, clearly designated material and need not be considered further.

*Habits and Habitat*.—*E. bimaculata* apparently inhabits the relatively elevated region of the lower Yangtze from Hankow to Chinkiang, but avoids the low, alluvial plain lying to the east of Chinkiang and inhabited in turn by

*dione*. The ranges and habitats of these closely allied but amply distinct species present an especially fascinating local problem for residents of central China.

Chang and Fang (1931, p. 275) state that at Nanking two specimens of *bimaculata* were captured in cages of albino mice and did not attempt to escape when the cages were opened but crawled very rapidly when once disturbed. Mice seemed to be their favorite food. One female contained 8 eggs. An egg measured about 35 x 20 mm.

American Museum No. 50800 had in its stomach the tail of a gecko (*Gekko*), while No. 50802 contained the remains of a field mouse.

*Material examined*.—I have seen the following material: the type and 2 paratypes and 2 specimens from Wuchang, in the American Museum; specimens "q" through "t" of Boulenger, 1894, p. 45, in the British Museum; 1 example from the Hankow region, in the Naturhistorisches Museum, Vienna; and 1 from Hangchow, in the U. S. National Museum.

*Remarks*.—*Elaphe dione* and *bimaculata* strongly resemble each other but may always be distinguished by the following characters:

1. The hemipenes differ as explained in detail under *dione*.
2. *E. bimaculata* has 10, sometimes 8 or 9, rarely 11, lower labials (data based on two examples from Wuchang, one from Hangchow, one from Nanking, the type, two paratypes and Boulenger's 1894, p. 45, specimens "q" through "t"), while *dione*, as shown in the table under that form, normally has 11 or 12, very rarely 10 (or 13). In fact, only five counts of 10 were made among a total of one hundred thirty-six on sixty-eight specimens.
3. The central design of the posterior part of the head extends backward far along the neck as two narrow stripes in *bimaculata*, while in *dione* these posterior nuchal extensions usually expand into blotches and are always shorter than in *bimaculata*.
4. The paired dorsal blotches of *bimaculata* are either joined to form a dumb-bell design or isolated as rounded, black-edged spots. In *dione*, the middorsum is generally decorated with narrow, black, transverse bars which may, however, break up into paired spots as in the other species. The distinction here is not always great.
5. There are 18-20 maxillary teeth in *bimaculata*, 15-17 in *dione*.

Other smaller differences do not warrant elaboration here.

#### 59. *Elaphe carinata* (Guenther)

Plate XXVII, B, and Figure 51

*Elaphis sauromates* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 93 (Ningpo) (not of Pallas, 1811); 1864, Rept. Brit. India, p. 241, Pl. XXI (part: Ningpo); 1888, Ann. Mag. Nat. Hist., (6) I, p. 170 (Lushan, Kiangsi) (not of Pallas, 1811).

*Phyllophis carinata* Guenther, 1864, Rept. Brit. India, p. 295, Pl. XXI (type locality, China).

*Coluber phyllophis* Boulenger, 1891, Ann. Mag. Nat. Hist., (6) VII, p. 280 (type localities, Kiukiang, Kiangsi; and near Ningpo).

*Spaniopholis Souliei* Mocquard, 1897, Bull. Mus. Hist. Nat., Paris, III, p. 216 (type locality, Tseku, Yunnan).

*Elaphe carinata* Stejneger, 1898, Journ. Sci. Col. Tokyo, XII, pt. 3, p. 221 (Formosa).

*Spaniopholis kreyenbergi* Müller, 1907, Zool. Anz., XXXI, p. 829 (type locality, Pingsiang, Kiangsi).

*Elaphe osborni* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 3 (type locality, Tengyueh, Yunnan); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 534, fig. 18 (amplified description of type).

*Coluber camillo-schneideri* Vogt, 1927, Zool. Anz., LXIX, p. 284 (type locality, southern China).

*Elaphe kreyenbergi* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 438 (Chungan Hsien, Fukien).

*Coluber osborni* Werner, 1929, Zool. Jahrb., Syst., LVII, p. 87.

*Elaphe carinata carinata* Mell, 1931, Lingnan Sci. Journ., VIII, p. 208.

*Elaphe carinata souliei* Mell, 1931, l.c.

*Elaphe kreyenbergi kreyenbergi* Mell, 1931, Lingnan Sci. Journ., VIII, p. 209.

*Elaphe kreyenbergi osborni* Mell, 1931, l.c.

*Description*.—Upper labials 8, very rarely 7; preoculars 2, rarely 3, very rarely 1; postoculars 2, very rarely 3; anterior temporals 2, occasionally 3, very rarely 1; posterior temporals 3, occasionally 2, very rarely 4; scales heavily keeled, in 23, occasionally 21, rows on the neck, 23, very rarely 21, at midbody, and 19, occasionally 17, before the vent; ventrals 215-226; subcaudals in eight males 92-101, in ten females 84-99. (Description based on twenty-eight specimens from Chungan Hsien.)

There is apparently no sexual dimorphism in the number of ventral plates (Pope, 1929, p. 437). Wall (1903, p. 92) records a specimen 8 feet 1 inch long, figures that certainly represent an unusually large individual. The remarkably distinctive juvenile pattern of *carinata* is still relatively unchanged in a Chungan Hsien specimen measuring 521 mm. from snout to vent, but largely lost in one from the same locality 727 mm. long. This color change has already misled no less than six herpetologists, myself among them, and has been responsible for the renaming of *carinata* five times!

Like so many other species of the genus *Elaphe*, the present one exhibits puzzling variations in ventral counts, but I am unable to correlate these with any consistent geographical distribution. The color pattern is likewise confusing because of its inconsistent variations. For instance, a Yunnanfu example in the American Museum is almost entirely black, while this color in one from Tungchwan in the British Museum is reduced anteriorly to very narrow cross-bands. Thus the two extreme types of pattern occur relatively near together in eastern Yunnan on the plateau.

*E. carinata* gives off a strong odor when handled, a fact no doubt correlated with the enormous development of the anal gland. This gland extends to the fourteenth subcaudal plate and is 62 mm. long in a male with a total length of 1450 mm. I have never seen an anal gland of comparable size in any other species.

The original description, based on the type, an immature specimen, follows:

Rostral shield not quite as high as broad; anterior frontals subtruncated in front, more than half as large as posterior; posterior frontals rather broader than long, bent downwards on the sides; vertical five-sided, two-thirds as broad as long; supraciliaries not much smaller than vertical; occipitals rounded behind. Nostril round, open, in an undivided shield; loreal longer than high; two præoculars, the upper of which is the larger, and extending on to the upper surface of the head, but not touching the vertical; the lower is small, intercalated be-

tween the third and fourth labials. Two postoculars; temporals rather irregularly arranged,  $2 + 2 + 3$ , the two anterior being the largest and in contact with the postoculars. Eight upper labials, the fourth and fifth entering the orbit. Two pairs of elongate chin-shields, the anterior being in contact with five lower labials. Scales rather strongly keeled, only the outermost series being composed of perfectly smooth scales. Ventrals 223; anal bifid; subcaudals 97. The teeth are subequal in size, of moderate strength; there are eleven in each maxillary. Upper parts uniform greenish olive (in spirits); a pair of black dots on the nape of the neck, and some very small, distant, black specks along the vertebral line. Lower parts uniform whitish.

I have examined only one specimen of this new species, said to be from China; it is 21 inches long, the head measuring 10 lines, and the tail  $4\frac{1}{2}$  inches.

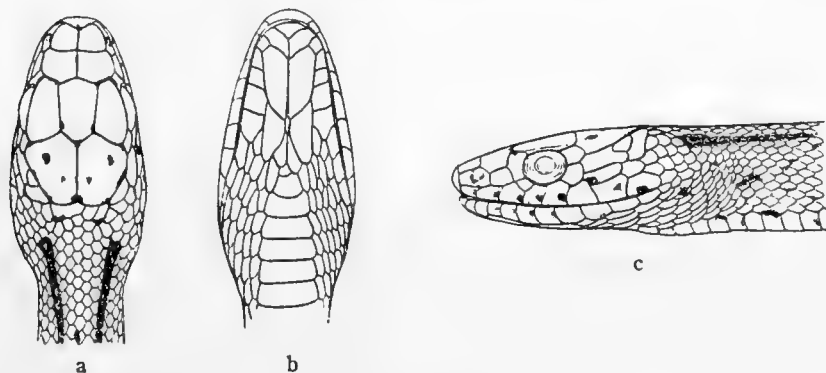


FIG. 51. *Elaphe carinata*.  $\times 1\frac{1}{2}$ . Juvenile head-pattern. a. Dorsal view. b. Ventral view. c. Lateral view. A.M.N.H. No. 21073 from Tengyueh, Yunnan.

The hemipenis extends to the sixteenth subcaudal plate. It is spinous proximally, calyculate distally, the calyces covering an area about twice as extensive as that occupied by the spines, while the latter begin some distance distal to the base of the organ. The spines are uniform in size with the exception of a few small proximal ones. Each large spine is blunt and cylindrical but surmounted by a minute, sharp point. The line of demarcation between spines and calyces is abrupt and extends almost straight across the hemipenis. The calyces have irregularly, rather shallowly scalloped edges and terminate a short distance proximal to the end of the sulcus. They become gradually smaller distally but are uniform in structure save for a longitudinal area lying adjacent to one side of the sulcus where they are smooth-edged and very shallow. The sulcus is conspicuous throughout, its lips entirely devoid of spines and scarcely encroached upon by the calyces. Distally, the sulcus appears to be set in a conspicuous, calyculate ridge that is paralleled by a similar one. The ridge in which the sulcus lies extends beyond the calyculate area and as far as the extremity of the sulcus. (Description based on a specimen from Chungan Hsien.)

One of the Kiangsi cotypes of *Coluber phyllophis* seems to have, not one,

but three ridges parallel to the one in which the sulcus lies. The importance that may be attached to these ridges is somewhat problematic because, when the organ is stretched laterally, they tend to disappear and may be more apparent than truly structural.

*Distribution*.—This species, apparently confined to China and Formosa, has been collected at the following localities in China:

Kwangtung: Hunan boundary, 800 meters.

Fukien: Futsing Hsien; Chungan Hsien (including Kuatun).

Kiangsi: Lushan; Kiukiang; Hokow; Pingsiang.

Chekiang: Wenchow; Taichow; Ningpo and region; Hangchow; Fuyang; Tunghu.

Kiangsu: Nanking; Chihsianshan.

Anhui: Chuchow.

Hupei: Kingchow.

Szechwan: Süchow; Fulin region, 9000 feet; Huangchiakou; Lungan.

Yunnan: Tungchwan; Yunnanfu; Erh Hai; Tengyueh; between Yungning, Yungpeh and Likiang; Tseku.

*Habits and Habitat*.—*E. carinata* is a mountain-loving snake in spite of the fact that it descends to relatively low altitudes in the lower Yangtze Valley. I (1929, l.c.) found it abundant in the high mountains about Kuatun and Sanchiang and not rare on the Chungan Hsien plateau. Its presence on the Yunnan plateau and at such localities in western Yunnan as Tengyueh, Erh Hai, Tungchwan, etc., proves that it is common at considerable elevations in that province, while a specimen in the U. S. National Museum was collected at 9000 feet in the Fulin region of Szechwan.

This species, though very active, alert and quick in its movements, is, nevertheless, quite docile and easily handled. It was encountered on relatively open but rough, overgrown mountain sides as well as in deep bamboo forests of the Kuatun-Sanchiang region. On Formosa it is "very common in grass land, fields, and in the neighbourhood of dwellings" (Maki, 1931, p. 93).

Maki (1931, l.c.) states that *carinata* eats snakes, and the data, based on field notes and dissection of specimens in the American and the U. S. National Museums, and set forth in Table XXX, substantiate this view in part, but indicate that other kinds of food are also taken by juveniles and perhaps by adults (possibly the bird whose legs were found in No. 76253 had been eaten first by an ophidian victim of that large *carinata*).

The fact that this species will not only eat various kinds of snakes, but also its own young, is of great interest. Does the distinctive juvenile pattern keep the hungry adult from recognizing its own kind? Here is a fertile field for study of the senses used by snakes in detecting prey, and also for determination of the degree of immunity to ophidian venom found in ophiophagous species that include poisonous victims in their diet.



TABLE XXX. FOOD OF *ELAPHE CARINATA* IN CHINA

Total Length or Approximate Size of <i>carinata</i>	Length of Prey	Identification of Prey
521 mm. (juvenile); American Museum No. 34682.....	116 mm.	<i>Leiolopisma</i> species
717 mm. (juvenile); American Museum No. 34637.....		<i>Megophrys</i> species
727 mm. (juvenile); American Museum No. 34636.....		<i>Natrix percarinata</i>
"half-grown".....	1330 mm.	<i>Boiga kræpelini</i>
large adult.....	"about 5 feet"	<i>Zaocys dhumnades montanus</i>
	"about 1 foot"	<i>Agkistrodon acutus</i>
large adult.....	between 468 and 727 mm. (juvenile)	<i>Elaphe carinata</i>
large adult; U. S. Nat. Mus. No. 76253.....		unidentifiable legs of a bird

Nothing has been recorded on the breeding habits of *carinata* save the following (Pope, 1929, p. 438):

On the 29th of July a batch of 12 white, adherent eggs, obviously deposited by this species, was found buried near the loose surface of a pile of soft, decaying bamboo waste lying in a clearing of the high bamboo forests near Kuatun. Three adults were taken at the pile, one of them a female containing 12 well-developed eggs. Three of the eggs taken from the "nest" measured 47 x 30.5, 51 x 29, and 45 x 29 mm., respectively.

*Material examined*:—I have seen the following Chinese material: the type of *Phyllophis carinata* and type series of *Coluber phyllophis*, 1 example from the Ningpo region, 2 from Kuatun, 1 from Tungchwan, and 2 from China, in the British Museum; the type of *Spaniopholis souliei*, in the Paris Museum; the type of *Coluber camillo-schneideri*, in the Berlin Museum; 1 specimen each from Kwangtung (Mell Collection), Fuyang, Tunglu and Yunnanfu, in the Museum of Comparative Zoölogy; 1 each from Sūchow, Huangchiakou and the region of Fulin, in the U. S. National Museum; 28 from Chungan Hsien, 2 from Futsing Hsien, 1 each from Hokow, Yunnanfu and Tengyueh, and the type and paratype of *Elaphe osborni*, in the American Museum.

*Remarks*:—As already stated, the remarkable ontogenetic color change of *carinata* is undoubtedly largely responsible for its long synonymy but probably not to blame for the erection of two genera, namely *Phyllophis* (Guenther, 1864, p. 294) and *Spaniopholis* (Mocquard, 1897, p. 216), on this single species. Since

the diagnosis of *Phyllophis* contains no single character that could be considered of generic rank, one is forced to conclude that Guenther was struck by the general appearance of *carinata*. Mocquard, on the other hand, describes the pupil of his new genus as elliptical, a character sometimes regarded as especially significant in snakes. However, a careful study of the large series in the American Museum reveals only a single individual in which the pupil could possibly be described as anything but round and, in this specimen, the pupil is only slightly elliptical. It is obvious, then, that although the eye of *carinata* may be interesting in its anatomy, it cannot be used as a character in taxonomy. Nevertheless, the question of the status of *carinata* should not be considered closed because the hemipenis of *carinata* is characteristic, and when the unwieldy genus to which it belongs is properly overhauled, sufficient justification for its isolation may be demonstrated. In this connection, the comparison of the copulatory organ of *davidi* to that of *carinata*, made under *davidi*, should be given special attention.

#### 60. *Elaphe davidi* (Sauvage)

Figure 52

*Tropidonotus Davidi* Sauvage, 1884, Bull. Soc. Philom. Paris, (7) VIII, p. 144 (type locality, China).

*Coluber halli* Boulenger, 1914, Ann. Mag. Nat. Hist., (8) XIII, p. 576 (type locality, Chihfeng, Jehol); 1916, (8) XVII, p. 243 (Chihfeng).

*Description*.—Upper labials 8, 4th and 5th entering orbit; preoculars 2; postoculars 2, occasionally 3; anterior temporals 2 or 3, rarely 1; scales heavily keeled, in 23 or 25 rows at midbody, 19, rarely 21 or 17, before vent; ventrals in four males 171-173, in three females 173-181; subcaudals in four males 65-69, in three females 58-64; total length (of one specimen) 940 mm. (Description based on seven specimens from Chihfeng, including the two cotypes of *halli*.)

There are 71 subcaudals and approximately 174 ventrals in the male from the Tungling, near Moukden, while the "Peking" female has 179 ventrals and 66 subcaudals. Judging by these two specimens, the maxillary teeth are about equal in size and 15 or 16 in number.

The characteristic pattern of *davidi* consists of a middorsal and two lateral rows of numerous, black-edged, dark brown, elliptical spots on a background of lighter brown, the spots of the median row being two or more times as large as those of the lateral ones. An indistinct, light, middorsal stripe is evident only between the large spots. Each ventral plate is irregularly mottled with light gray, while every second or third one has a small, dark spot on either end. A dark band arches forward across the head from the eyes and is continued as a conspicuous postocular stripe. Numerous additional dark markings complete the rather complicated head pattern, most of the dark elements of which are also black-margined.

The pattern of the young differs from that of the adult only in distinctness, the difference being most evident on the head.

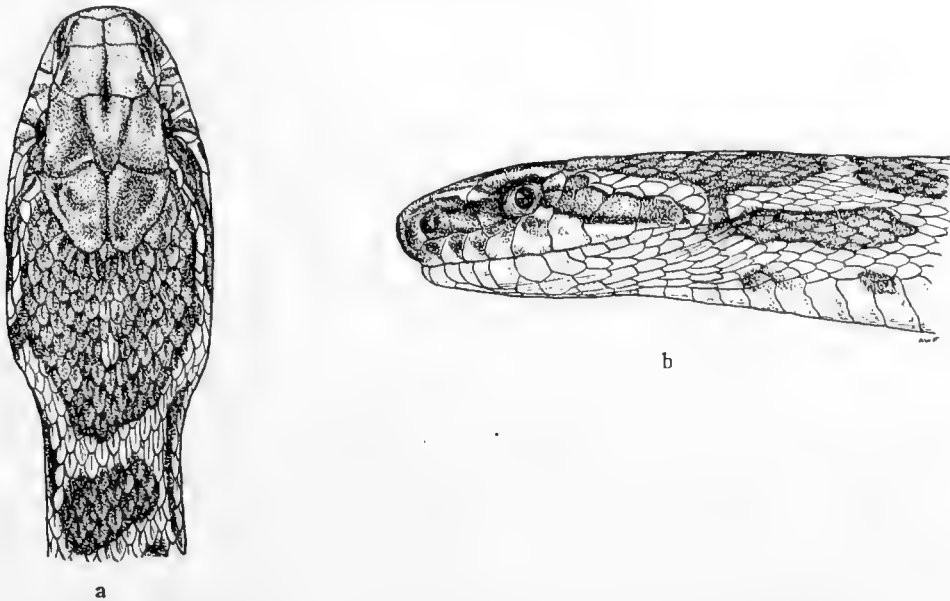


FIG. 52. *Elaphe davidi*.  $\times 1\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head.

A translation of the original description of the type, a male, follows:

Frontal long, concave on the outer borders, pointed at the posterior angle; temporals in two rows; 8 labials, the 4th and 5th touching the eye; 2 postoculars, the upper larger; frenal short; body of a yellowish brown, with large, irregular brown spots, irregularly disposed; no spots or bands on the head. Length, 700 mm.

The type has heavily keeled scales in 23 rows on the neck, 23 (22) at mid-body, and 19 before the vent; 173 ventrals; 69 subcaudals; 3 preoculars (irregular); and 3 anterior temporals.

The hemipenis extends to the fourteenth subcaudal plate. It is spinous proximally, calyculate distally, the calyces covering a slightly less extensive area than the spines, while the latter begin a short distance distal to the base of the organ. The numerous spines are slightly curved, pointed, uniform in size and shape, and cylindrical or somewhat compressed laterally. The line of demarcation between spines and calyces is abrupt and extends almost straight across the hemipenis. The shallow calyces become gradually smaller distally and terminate a short distance proximal to the end of the sulcus. Their edges are surmounted by very small but distinct spines. These spines and the calyces on which they rest are distinctly reduced in size along one side of the sulcus. The lips of the sulcus are well developed throughout and entirely devoid of spines in the spinous area, while in the calyculate region they are scarcely en-

croached upon by the calyces but do bear a few small spines laterally. (Description based on the specimen from the Tungling, near Moukden.)

A comparison of the above description with that under *carinata* shows that the copulatory organs of *davidi* and *carinata* have two very unusual characters in common, i.e.:

a. The extension of the sulcus beyond the termination of the calyculate area.

b. A reduction in size of the calyces along one side of the sulcus. In addition, the organs in question agree in several more usual characters, but the spines present on the calyces of *davidi* are not evident in *carinata*, and, in fact, the former is most unusual in this respect.

*Distribution*.—*E. davidi* is known with certainty only from Chihfeng in Jehol, and the Tungling near Moukden. A specimen loaned to the American Museum by Dr. Boring is labeled "Peking" but some doubt is attached to this record.

*Habits and Habitat*.—The types of *halli* were found in "rocky gullies" (Boulenger, 1914, p. 576). Judging by the localities where it has been collected, *davidi* frequents open river valleys or plains of low to moderate altitudes.

Mr. Parker has kindly examined the stomachs of the British Museum series of this species and has determined that one specimen contains the remains of a snake, *Elaphe dione*.

*Material examined*.—I have seen the type in the Paris Museum; the 2 cotypes of *halli*, and 5 topotypes, in the British Museum; 1 labeled "Peking" and 1 from the Tungling, near Moukden, both of these latter loaned to the American Museum by Dr. Boring and Mr. Liu.

*Remarks*.—Werner remarked in 1929 (p. 88) that *halli* and *davidi* might be identical.

Although *davidi* and *carinata* are perfectly distinct as species, their habitus, scalation (formula and keeling) and hemipenes (see above) clearly demonstrate a certain degree of relationship. It is interesting to note that *davidi* also eats snakes.

#### 61. *Elaphe dione* (Pallas)

Plate IX, D, E and F

*Coluber Dione* Pallas, 1773, Reise Russ. Reichs, II, p. 717 (type locality, "Salt steppes toward the Caspian Sea").—Boulenger, 1894, Cat. Snakes Brit. Mus., II, p. 44 (part: specimens "a" through "p," "u" and "v").—Holtzinger-Tenever, 1919, Archiv. Naturg., LXXXV, Abt. A, Heft 11, p. 91 (part: Shanghai).

*Elaphis Dione* Duméril and Bibron, 1854, Erp. Gén., VII, p. 248.

*Elaphe dione* Stejneger, 1907, Herp. Japan, p. 315, fig. 272 (exclusive of quoted records for Kiukiang and "Hainan").—Nikolsky, 1916, Faune Russie, Rept., II, p. 122 (Peiping; Ordos; Upper Yellow River; Sining, Chinghai; Kaichanchi, Kansu; region of Wutaishan, Shansi, etc.).

*Zamenis Pellioti* Mocquard, 1910, Bull. Mus. Hist. Nat., Paris, XVI, p. 150 (type locality, "Kö Kiu Wein," vicinity of Lanchow, Kansu).

*Description*.—Upper labials 8, rarely 9; preoculars 2, very rarely 3; postoculars 2; anterior temporals 2, rarely 3; posterior temporals 3 or 4; scales

feebly keeled, in 25, occasionally 23 or 27, rarely 24, very rarely 26, rows on the neck, 25, occasionally 27, rarely 29, at midbody, and 19, rarely 21, very rarely 18, before the vent; ventrals in fourteen males 179-194, in seventeen females 191-205; subcaudals in twelve males 67-80, in fourteen females 58-70; four largest males, from snout to vent, 843, 820, 780 and 650, females 885, 835, 733 and 720 mm. (Description based on thirty-one specimens from Peiping and the Western Hills.)

Although sexual dimorphism in size is not marked, the female apparently attains the greater length (Schmidt, 1927, p. 530; Pope, 1929, p. 444). The data given in the latter reference are in part included above.

Table XXXI summarizes the lower labial counts of sixty-eight American Museum specimens from localities in Shansi, Suiyuan, Hopei and Shantung.

TABLE XXXI. LOWER LABIAL COUNTS OF *ELAPHE DIONE* FROM CHINA

Locality	No. of Speci- mens	Lower Labials 10-11	Lower Labials 11-11	Lower Labials 11-12	Lower Labials 12-12	Lower Labials 11-13	Lower Labials 12-13	Lower Labials 13-13
Chintzu.....	8		2	2	1	1	1	1
Sohuang.....	9		5	1	3			
Tsinglo.....	2	1		1				
Maitaichao.....	10	1	4	2	2		1	
Hsinglungshan and re- gion.....	3	1		2				
Peiping and Western Hills.....	31	1	17	5	4	2	2	
Tsinan and region.....	5	1	2	1	1			
Total.....	68	5	30	14	11	3	4	1

A translation of the original description follows:

Body slender, three feet in length, tail occupying approximately a sixth part of the length. No fangs, pecten of the palate fourfold. Head small, quadrangular, usually reticulated with fuscous sutures. Color above pleasantly gray, indeed often whitish, with three whiter longitudinal streaks, between which are placed blotches alternately fuscous or reticulated with fuscous, often running together somewhat; color below whitish, sprinkled with livid fuscous ["liudo," typ. err., = livido] blotches and often with reddish dots. Scutes 190-206. Scales on the tail in 66-58 pairs.

The hemipenis of *dione* is much like that of *bimaculata* but differs in the following details:

1. In *dione*, it extends only to the eleventh to thirteenth subcaudal plates, not to the sixteenth.

2. The narrow, longitudinal region of maximum development of spines and calyces adjacent to the sulcus is more highly developed in *dione*.

3. In *dione*, the calyces do not extend as far distally between the two narrow, longitudinal regions of maximum development of spines and calyces as they do in *bimaculata*.

4. The tendency of the calyces of *bimaculata* to break up into papilla-like structures is not evident in *dione*.

5. The scallops in *dione* are soft or only slightly stiffened.

I have examined the hemipenes of three specimens of *dione*, one each from Tsinglo, Maitaichao and 260 miles southeast of Sairusu, on the Kalgan Trail. They exhibit an unusual amount of variation.

*Distribution*.—This species, widely distributed in Eurasia from southeastern Europe eastward to the sea, enters China from the north. The extent to which it ranges southward in this country is indicated by the following locality records:

Kiangsu: Shanghai.

Shantung: Tsingtao; Weihsien; Tsinan region.

Shansi: Sohuang; Taiku; Taiyuan; region of Wutaishan.

Shensi: Yulin.

Kansu: "Kō Kiu Wein," vicinity of Lanchow; Kaichanchi.

Chinghai: Sining.

Three additional records, though too indefinite to be given above, are, nevertheless, of value: Szechwan by Steindachner, 1896, p. 506; Honan by Stanley, 1914, p. 28; and Anhwei by Jacot, 1931, p. 42. Also, I believe there is no reason to doubt Stanley's (1914, l.c.) Kunshan (Kiangsu) one.

*E. dione* seems to penetrate much farther southward in eastern than in western China. The explanation of this rather anomalous distribution is not apparent. Perhaps future collecting in the west will prove that *dione* is more widely distributed there than is now known.

I have discussed, under *E. bimaculata*, the relationship of its distribution to that of *dione* in eastern central China, and dealt with several alleged records of the latter which are actually based on material of the former.

*Habits and Habitat*.—This species rivals or exceeds any other snake in abundance throughout much of northern China (Sowerby, 1914, p. 163, and 1930, p. 15; Moellendorff, 1877, p. 104, Peiping and vicinity; Jacot, 1923, p. 260, parts of Shantung). I found it very common at Maitaichao, Chintzu and Sohuang, and only *Natrix tigrina lateralis* could compare with it in abundance at any of these localities. Sowerby (1912, p. 110) describes it as "very common in the Ordos Desert and in the loess country of the adjacent provinces."

*E. dione* frequents fields, terraces, graveyards, forests and their borders,

semi-deserts, etc. It is terrestrial and often enters dwellings (Sowerby, 1912, l.c.).

In China, *E. dione* eats birds and small mammals as is shown by the following data:

1. One specimen observed by me at Chintzu disgorged a bird.
2. American Museum No. 28301 contains two very young nestlings of a passerine bird and some eggshells.
3. American Museum No. 28289 contains the remains of a small bird.
4. American Museum Nos. 21481 and 28293 contain hair of mammals.
5. Wall (1903, p. 91) reports finding in one *dione* four young birds, one still partly enveloped in its shell.
6. Jacot (1923, p. 260) dissected five specimens, three of which contained young rats or mice.
7. Emelianov (1929, pp. 59 and 60) states that *dione* eats bird eggs, birds and mice.

Under *Elaphe davidi* I give a record of that species having eaten a specimen of *dione*, so *davidi* may be included among the enemies of *dione*.

Table XXXII summarizes information on the breeding of *dione* in Shansi, Suiyuan and Shantung based on material observed by me in the field or now in the American Museum.

TABLE XXXII. DATA ON BREEDING OF *ELAPHE DIONE* IN CHINA

Locality	Date	Description
Chintzu.....	July 27-28	5 of original lot of 11 eggs collected July 18 hatch, three of the hatchlings measuring 250 to 260 mm. in total length; 6 of the eggs measured from 35 to 42 mm. in length
Chintzu.....	July-August	8 well-developed eggs in gravid female, one egg measuring 28 x 17 mm.
Tsinglo.....	August 14-15	6 hatchlings, from 195 to 212 mm. in total length, secured, each with an egg-tooth
Maitaichao.....	May	8 well-developed eggs in gravid female, one egg measuring 29 x 13 mm.
Maitaichao.....	May	4 well-developed eggs in gravid female, one egg measuring 43 x 14 mm.
Tsinan region...		11 well-developed eggs (Pope, 1929, p. 444)

Emelianov (1929, p. 60) gives the size of *dione* eggs in the Far Eastern District as 41 x 22 to 49 x 25 mm., the number laid "about 10," and states that a clutch deposited August 27 and kept in damp sand at a temperature of 18° to 25° C. hatched on September 25. He adds that young *dione* feed on small

cockroaches and measure about 210 mm. Sowerby (1914, p. 164) gives the period of incubation as about three weeks.

I have seen a hatchling defend itself vigorously, repeatedly striking and biting. Several others vibrated the tail when annoyed.

Much additional information on the habits of this snake may be found in Emelianov's account already cited, or gleaned from the special articles by Rembold (1909, pp. 553-557) and Kreyenberg (1910, pp. 543-545 and 561-562).

*Remarks:*—Maki (1931, Pl. xxxviii) and Sowerby (1912, opposite p. 110) have both given colored illustrations of this species.

## 62. *Elaphe frenata* (Gray)

Figure 53

- Herpetodryas frenatus* Gray, 1853, Ann. Mag. Nat. Hist., (2) XII, p. 390 (type locality, Khasya).  
*Gonyosoma frenatum* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 123.—Angel and Bourret, 1933, Bull. Soc. Zool. France, LVIII, p. 134 (Chapa, Tongking, about 1500 meters).  
*Coluber frenatus* Boulenger, 1890, Fauna Brit. India, p. 335; 1893, Cat. Snakes Brit. Mus., II, p. 58, Pl. III.—Parker, 1925, Ann. Mag. Nat. Hist., (9) XV, p. 305 (Ngoi-Tio, Tongking, 4500-6500 feet).  
*Rhadinophis melli* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 140.—Mell, 1922, p. 121, Pl. IV (type localities, Chayuanshan and Lungtou, Kwangtung, 550-800 meters).  
*Gonyosoma caldwelli* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 4 (type locality, Yenping, Fukien); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 535, fig. 19 (amplified description of type).  
*Gonyosoma melli* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 446 (Yenping and Chungan Hsien, Fukien).  
*Coluber caldwelli* Werner, 1929, Zool. Jahrb., Syst., LVII, p. 90.

*Description:*—Upper labials 8, occasionally 9, 3rd, 4th and 5th or 4th, 5th and 6th entering orbit; loreal absent; preoculars single; postoculars 2; anterior temporals 1 or 2; posterior temporals 2 or 3; scales feebly keeled, in 19 rows on the neck, 19 at midbody, and 15 before the vent; ventrals in males 217-223, females 213-223; subcaudals in males 108+ to 135+, in three females 129-135; males from snout to vent 1028 and 907, females 670, 347 and 291 mm. (Description based on three females from Chungan Hsien and two males from Yenping, one of them the type of *caldwelli*.)

As first brought out by Mell (1922, p. 122) and Vogt (1922, p. 140), the coloration of the young does not in the least resemble that of the adult. The description of a juvenile female from Chungan Hsien measuring 291 + 110 mm. follows:

The dorsum is gray, crossed by numerous more or less oblique, black bars which cover the width of four to six scales across the back and somewhat more than the length of a scale longitudinally and are separated by two to three scale lengths. These bars are irregular in outline, sometimes divided into halves, and always noticeably broken by small, gray areas slightly lighter than the ground color. Short, narrow, black streaks extend in a single or double series along either side. A conspicuous pattern of light-bordered black stripes is present on the nape and upper surface of the head, the stripes coinciding for the most part with the sutures of the plates but, in addition, each parietal is crossed longitudinally by a broad stripe which extends posteriorly onto the nape. The black pre- and postorbital stripes of the adult



are strong. The ventral surface of the head and the upper labials are whitish but conspicuously marked with roundish black spots, each labial or scale as a rule carrying one spot in its center. The belly is whitish to grayish, the majority of ventrals bearing two dark lateral spots. Weak median spots are discernible only on a few anterior ventrals. No sign of the adult green can as yet be detected anywhere. In fact, green still is not evident in a Chungan Hsien female 347 + 121 mm. long although its ground color is brown rather than gray.

Mell (1922, p. 121) gives the scale formula of his original Kwangtung material as 19-17-15-13, the ventrals and subcaudals, respectively, as 212-216 and 144-148. One would guess from these figures that his four specimens were all males. The Ngoi-Tio male reported by Parker (1925, p. 305) has 205 ventrals and 145 subcaudals, while the individual from Chapa discussed by Angel and Bourret more recently (1933, p. 134) has 210 and 133 ventrals and subcaudals, respectively.

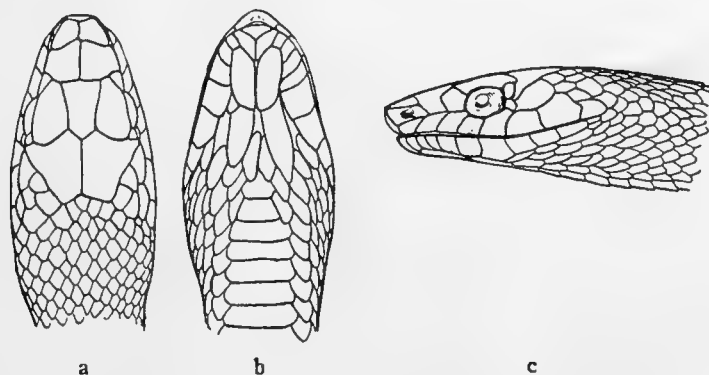


FIG. 53. *Elaphe frenata*. Nat. size. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 21010 from Yenping, Fukien.

The original description, based on the type specimen, a female, follows:

Green; lips and beneath white. Head with a broad black streak across the eye to the side of the neck. Eyes rather large. Scales smooth; ventral shield obtusely keeled on each side, with an opaque white narrow streak at the keel.

The hemipenis extends to the tenth (or eleventh) subcaudal plate. It is spinous proximally, calyculate distally, but the spinous area is only half as extensive as the calyculate one and no spines are present proximal to the fifth (or sixth) subcaudal plate. Only the first few spines are small, the others being large, uniform in size, thick, and straight save for curved tips. There are not more than twenty-five well-developed spines in all, and the line of demarcation between them and the calyces is fairly conspicuous and extends straight across the organ. The calyces are scalloped throughout, the proximal scallops deep and stiff, the mesial ones not so deep or stiff, while those near the extremity of the organ are quite soft, irregular in shape, and much less numerous. The transition from one type of scallop to another is gradual and there is also a

slight reduction in size distally. The sulcus terminates just proximal to the extremity of the hemipenis and is well developed throughout, but especially so proximal to the calyces. Its lips are calyculate distally but devoid of spines proximal to the calyculate area. (Description based on a specimen from Yenping.)

*Distribution*.—*E. frenata* is known from the following localities in China:

Fukien: Chungan Hsien; Yenping.

Kwangtung: Chayuanshan; Lungtou.

Described from the Khasi Hills, Assam, this snake has since been collected at Chapa and Ngoi-Tio, Tongking.

*Habits and Habitat*.—This species has been secured only in high mountains. Mell (1922, l.c.) gives its known vertical range in northern Kwangtung as 550 to 800 meters and states (p. 122) that he collected one juvenile in a pile of cut wood, another in a cavity of a rock, while two adults were found on bamboos in a forest.

Judging from three individuals handled by me in Fukien, *frenata* is very docile, for only one of the three would even attempt to bite and that one bit in a half-hearted manner without assuming a defensive attitude.

Observations to determine to what degree this snake is arboreal should be made.

*Material examined*.—I have seen the following material: the type and 1 specimen each from the Khasi Hills and Ngoi-Tio, in the British Museum; 3 from Chungan Hsien and 2 from Yenping (including the type of *caldwelli*), in the American Museum; and 3 cotypes of *melli*, in the Berlin Museum. This is all the material on record, with the exception of 2 specimens, 1 each from Kwangtung and Tongking.

*Remarks*.—Certainly there is no longer any excuse to consider *melli* of eastern China specifically distinct from *frenata* of Assam. Moreover, there is little doubt that Tongking specimens should be aligned with those from Kwangtung and Fukien. If future collections show that the subcaudal counts of material from Assam really are substantially lower than those of Tongking and eastern Chinese specimens, the latter will then warrant the subspecific name *Elaphe frenata melli*. Unfortunately, no male has yet been secured in Assam, while only two females are known from there.

### 63. *Elaphe mandarinus* (Cantor)

Plate X, A, B and C

*Coluber mandarinus* Cantor, 1842, Ann. Mag. Nat. Hist., IX, p. 483 (type locality, Chusan Island).

*Elaphe mandarinus* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 84 (Mokanshan, Chekiang; and Hsinkingtsu on Mt. Omei, Szechwan).—Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII,

p. 55, fig. 17 (near Hsienshanszu on Mt. Omei, Szechwan, 2300 meters; Yenchinghsi of Opian Hsien, Szechwan, 1040 meters).

*Holarchus Roulei* Angel and Bourret, 1933, Bull. Soc. Zool. France, LVIII, p. 135 (type locality, Chapa, Tongking, about 1500 meters).

*Description*.—Upper labials 7, 3rd and 4th entering orbit; preoculars single; postoculars 1 or 2; anterior temporals 2, occasionally 3; posterior temporals 2 or 3; scales smooth, in 23 rows on the neck and at midbody, 19 before the vent; ventrals 214-215; subcaudals 72 (one damaged); length from snout to vent 900, 868 and 635 mm. Color gray above with 24-28 plus about 9-10 conspicuous, yellow-margined, yellow-centered, black saddles separated from one another by the length of 1-2 scales; belly light, boldly marked with black blotches covering 2-3 ventral plates; head gray with broad cross-bands, one of which divides over the eyes, the resulting pair of branches ending on the lower labials. (Description based on three males from Chungan Hsien.)

Table XXXIII records data on Tongking and additional Chinese material from widely separated localities.

I have checked the sex only on the Yenchingkou specimen recorded in Table XXXIII.

The hemipenis extends to the thirteenth to fourteenth subcaudal plates. It is spinous proximally and calyculate distally, the two sections thus differentiated being about equal in extent. There are two large, cylindrical basal spines or hooks set near to but on opposite sides of the sulcus. The spines distal to the basal hooks are at first large and scattered, but soon increase in number and decrease in size until they merge into the calyculate area. The total number of well-developed spines does not exceed twenty. A few minute spines are evident proximal to the basal hooks. The calyces have scalloped edges and are uniform save for a gradual reduction in size toward the end of the organ. The scallops of the proximal calyces are stiff and spine-like, a condition that gradually disappears distally. The lips of the sulcus bear only a few very small spines in the spinous region but are calyculate in the calyculate area. The sulcus is inconspicuous except at the tip of the hemipenis where it ends in a short, distinct, calyculate ridge. A similar but less distinct ridge parallels the one in which the sulcus terminates. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—*E. mandarinus* has been secured at the following Chinese localities:

Chekiang: Chusan Id.; Ningpo; Kashing; Mokanshan.

Fukien: Kuatun and Sanchiang (Chungan Hsien).

Kwangtung: Wanszushan.

Kweichow: (no specific locality).

Szechwan: Yenchingkou; Chungking; Süchow; Chouchiakou; Huangchiakou; Yenchinghsi of Opian Hsien; Fulin region; Mt. Omei.

TABLE XXXIII. VENTRAL, SUBCAUDAL AND SCALE ROW COUNTS AND DIMENSIONS OF *ELAPHE MANDARINUS* FROM CHINA AND TONGKING

Locality	Sex	Scales	Ventrals	Sub-caudals	Total Length in Millimeters	Material or Reference
Chusan Id....	♀	23	222	62		type
Chusan Id....		23	208	74		Boulenger, 1894, p. 43
Chusan Id....			207	67		specimen in British Museum
Mokanshan...		23	213			Stejneger, 1925, p. 84
Kuatun.....	♀		214			specimen in British Museum
Kuatun.....			215	63		specimen in British Museum
Fukien.....			214			specimen in British Museum
Yenchingkou..	♂	23-23-19	231	67+	864+172+	American Museum No. 23504
Chouchiakou..			196	63		U. S. Nat. Mus. No. 80101
Yenchingsi...		23	235	69	595+102	Chang, 1932, p. 57
Mt. Omei.....		23	226	65	892+142	Chang, 1932, p. 57
Mt. Omei.....	♂	23	220	70		Stejneger, 1925, p. 84
Ngoi-Tio.....	♂		230	71		specimen in British Museum
Ngoi-Tio.....	♂		224	80		specimen in British Museum
Fansipan Mts.	♂		229	75	about 1700	specimen in British Museum

This species is also known from Tongking (Parker, 1925, p. 304; Smith, 1930, p. 681; and Angel and Bourret, 1933, p. 135) and has recently been recorded from the Burma-Tibet frontier by Smith (1932, p. 479).

*Habits and Habitat*.—Although little has been written on the habits of *mandarinus*, the locality records indicate that it is essentially an inhabitant of

forested mountains. It has thrice been collected in the high Kuatun range, Mell (1922, p. 120) secured it at 700 meters in northern Kwangtung, Parker (1925, l.c.) lists it from 4500-6500 feet in Tongking, while the Szechwan series in the U. S. National Museum was obtained for the most part at altitudes ranging from 2000 to 5000 feet. Moreover, Chang (1932, p. 57) records additional Szechwan material from 2300 meters on Mt. Omei and 1040 meters at Yenchinghsi, and Formosan *takasago*, discussed below, occurs at about 2000-3000 meters (Maki, 1931, p. 106).

Mell (1922, l.c.) found his Kwangtung specimen in a dry field. I (1929, p. 440) have already reported the capture of one in a vine-grown, boulder-strewn opening of the forests near Sanchiang. This last individual was slow and deliberate in its movements and quite docile. I also saw a very tame one kept in captivity at Wuhu.

Nothing is known of the food of *mandarinus* except that the stomach of one Chungan Hsien specimen holds balls of short gray hair (Pope, 1929, l.c.), while that of a Yenchingkou individual, also in the American Museum, contains remains of a small mammal, apparently a shrew.

*Material examined*.—I have seen the following specimens: the type and 2 other examples from Chusan Id., 2 from Kuatun, 1 from Fukien, 3 from Tongking (Ngoi-Tio and the Fansipan Mts.), in the British Museum; 1 from Yenchingkou, 3 from Chungan Hsien, and 1 bought at Wuhu, in the American Museum; 1 from Kuatun, 1 from Mokanshan, 1 from Chungking, 2000 feet, 2 from Süchow, 3 from Huangchiakou, 3500 feet, 1 from Hsinkaiszu, 1 from the Fulin region, 3000-5000 feet, and 2 from Chouchiakou, 3000 feet, in the U. S. National Museum.

*Remarks*.—Formosan *mandarinus* was described in 1930 by Takahashi as *Elaphe takasago* and treated by Maki (1931, p. 105) as a subspecies. It has a slightly higher number of ventrals (232-238 in two males and one female) than Fukien specimens but matches them in color very well. On the other hand its ventral count is almost equalled by Tongking and Szechwan *mandarinus* and I doubt that the data available at present warrant its retention as a distinct form. However, it must be admitted that the recognition or suppression of various forms of *Elaphe* in eastern Asia is largely a matter of individual viewpoint. Small average differences in ventral and subcaudal counts can be detected in most of the widespread species and the evaluation of such differences is a difficult task.

Moellendorff (1877, p. 104) recorded *Coluber mandarinus* from Hopei but described it as "a black water snake with orange-red marks." As already pointed out by Boulenger (1894, p. 42), this description can scarcely refer to *mandarinus*. The combination of a docile disposition with a beautiful pattern

probably results in the frequent transportation of *mandarinus* by man. Moellendorff might have seen a captive specimen in Hopei and later confused its description with that of some other snake. He certainly gives the correct Chinese name of *mandarinus*.

64. *Elaphe moellendorffi* (Boettger)

Plate X, D, E, F, G and H

*Cynophis Moellendorffi* Boettger, 1886, Zool. Anz., IX, p. 520 (type localities, near Nanning, Kwangsi; and near Canton); 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 72, Pl. 1 (amplified description of cotypes); p. 133 (Nanning and Canton).

*Coluber moellendorffii* Boulenger, 1894, Cat. Snakes Brit. Mus., II, p. 56.

*Elaphe moellendorffii* Stejneger, 1907, Herp. Japan, p. 322.

*Description*.—A translation of the original description, based on the two cotypes, follows:

Head elongate, pear-shaped; body long, slender; ventrals with a lateral angle, tail somewhat compressed laterally. Prefrontals very large, equalling the frontal in length, two and a half times as long as the internasals. Frenal twice as long as high. A very large preocular, larger than the eye; a distinct, large pseudopreocular, placed above the fifth supralabial. Ten low supralabials, somewhat quadrangular, the sixth and seventh in contact with the eye. Seven to 8 infralabials bordering the postmentals. Scales with two pores, 15-17 rows on the middle of the back moderately keeled. Squ. 27; Gul. 3, Ventr. 268-274, An. 1/1, Subcaud. 97/97—99/99.

Above, bright gray with unmarked head, ornamented on the back with 31-32 large, hexagonal, dark gray spots bordered with black. In the spaces between these on each side of the body, a series of similar but smaller spots. Tail bright fleshy-red marked with 11-12 broad black rings. Below whitish, labials grayish, lower surface of the neck, belly and tail thickly tessellated with black and white in equal portions. Length of the head as far as the apex of the parietals 36, of the trunk 1309, of the tail 310 mm.; total length 1655 mm.

I have determined the sex of the Nanning cotype as male. Two males from Tongking in the Paris Museum have 268 ventrals each, 93 and 98 subcaudals, and 27 scale rows at midbody with all but the outer keeled posteriorly, while the Cai Kim male in the British Museum has 284 ventrals and 98 subcaudals. Mell (1922, p. 120) records a Kwangtung example 2150 mm. in total length.

The hemipenis is spinous proximally, calyculate distally, the calyculate area somewhat the more extensive and set off from the spinous section abruptly. The spines are numerous and uniform in size but the calyces become much smaller toward the end of the organ. Their edges are scalloped. Distally, the sulcus lies deep in a distinctly raised calyculate ridge, while a second longitudinal ridge parallels the one in which the sulcus is imbedded but is evident only along the distal third of the organ. (Description based on a specimen from Cai Kim.)

*Distribution*.—In China, this handsome snake has been definitely recorded

only from Nanning in Kwangsi; Canton, Wuyung, and Namkong in Kwangtung. It is also known from Tongking.

*Habits and Habitat*.—No one but Mell has published field observations on *moellendorffi*. He (1922, l.c.) states that it is not rare east of Canton about Wuyung and Namkong and gives its vertical range there as from 50 to 300 meters above sea-level.

*Material examined*.—I have seen the cotype from near Nanning, in the Senckenbergisches Museum, Frankfurt; 1 specimen from Cai Kim, Tongking, in the British Museum; and 2 from Tongking, in the Paris Museum.

*Remarks*.—Since the Canton cotype has been dropped from the record of material in the Senckenbergisches Museum (Boettger, 1898, pp. vii and 52, and Mertens, 1922, p. 180), while the Nanning one remains, it is well to restrict the type locality to Nanning.

#### 65. *Elaphe perlacea* Stejneger

Figure 54

*Elaphe perlacea* Stejneger, 1929, Proc. Biol. Soc. Wash., XLII, p. 129 (type locality, Yachow Prefecture, Szechwan).

*Description*.—The original description of the type specimen, a male, follows:

Rostral much broader than high, broadly visible from above, sutures with internasals much longer than suture between the latter; internasals small, much broader than long, about two-thirds the size of the prefrontals, which are broadly in contact with supraocular; frontal as long as its distance from tip of snout, slightly longer than its width and the interparietal suture, somewhat broader in front than behind; parietals as long as frontal; nostril large between two subequal nasals; loreal trapezoid, much longer than high; one preocular widely separated from frontal; no subpreocular; two small postoculars, both in contact with parietal, upper not in contact with anterior temporal; temporals 1 + 2; supralabials 7, third and fourth entering eye; 3 lower labials in contact with anterior chin-shields, which are slightly longer than the posterior; posterior chin-shields separated from each other by two small scales, in contact with one sublabial; 19 rows of scales, 11 to 13 rows very distinctly keeled, four lateral scales smooth anteriorly and three at midbody; towards vent and on tail all scales keeled, ventrals 229, obtusely angulate laterally; anal divided; 69 pairs of subcaudals. Color (in alcohol) tawny gray, more plumbeous on the sides and underneath; upper side of body and tail with a pattern of narrow black equidistant cross-bands formed by the black tips and bases of two adjacent scale rows the centers of most of the scales being whitish; each two cross-bands being joined at or on the ventrals so as to form about 37 oval rings, the effect being a continuous black garland studded with strongly contrasting white beads; underside plumbeous checkered with black blotches edged with white; head pattern black, very distinct; a band from first labial through nostril across the suture between rostral and internasals; another similar but broader, from suture between third and fourth supralabial through eye over posterior half of prefrontals, bifurcating in the eye projecting a broad black line backwards across postoculars, anterior half of first temporal to upper anterior part of sixth supra-

labial; a black  $\wedge$ -shaped figure, the apex on the posterior half of frontal, extending backwards over parietals where bifurcating, the outer branch extending across second row of temporals to seventh supralabial, the inner parallel with the interparietal suture to the neck; on the lower lip one black spot on the suture between third and fourth sublabials appears as a continuation of the ocular band; another smaller spot on suture between second sublabial and anterior chin-shield.

On account of the hardness of the specimen the body can not be stretched sufficiently for very exact measurements. The body length is approximately 940 mm., tail 210 mm., total length 1150 mm. The ratio between body and tail is consequently about 4.5 : 1.

Obvious typographical errors have been corrected in lines 15, 27 and 31 of the original description as given above.

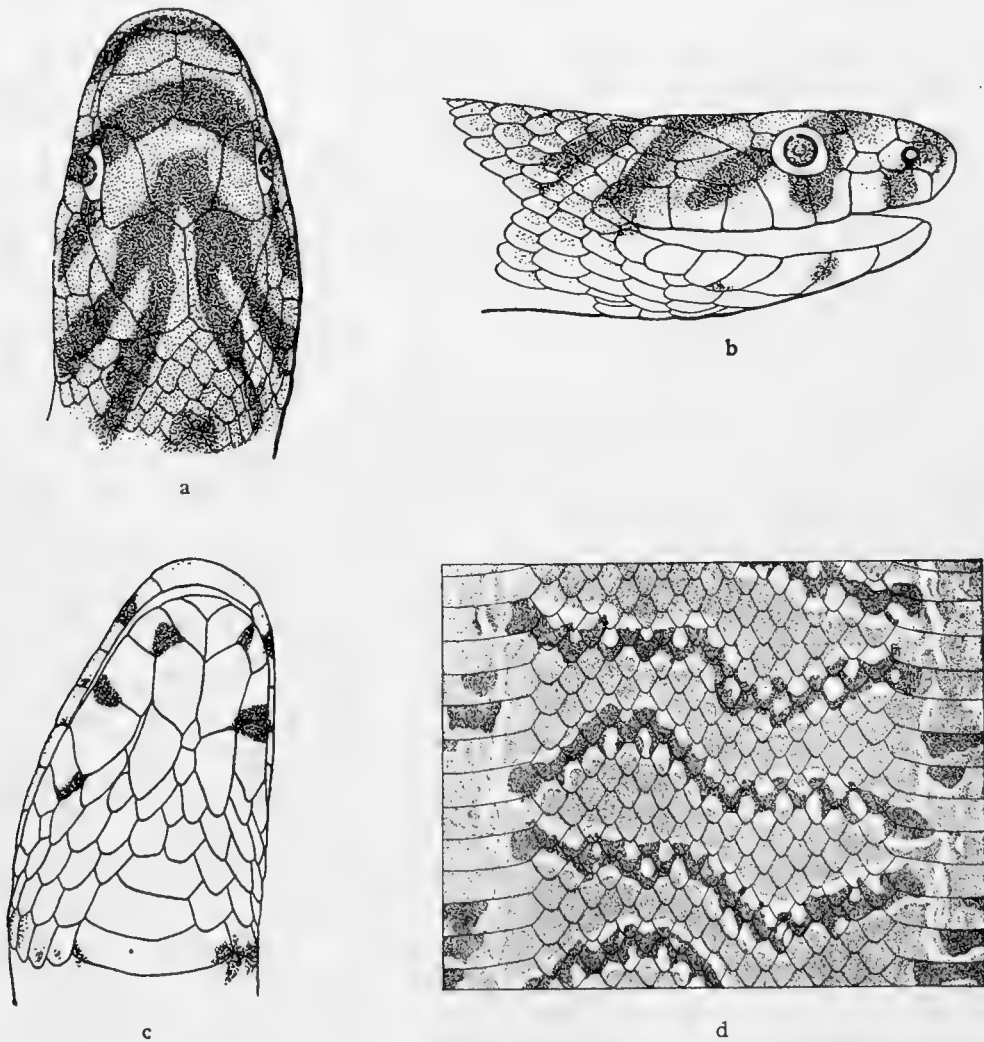


FIG. 54. *Elaphe perlacea*. Type. a. Dorsal view of head. b. Lateral view of head. c. Ventral view of head. d. Pattern of body. a, b and c  $\times 2$ , d nat. size.



The complete scale formula is 19-17, a single reduction taking place somewhat posterior to midbody. The nasal is undivided above the nostril and doubtfully divided below it, the original description notwithstanding.

The hemipenis is strikingly like that of *mandarinus* but has generally sharper and slenderer spines and scallops. Moreover, in *perlacea*, the organ ends opposite the fifteenth subcaudal plate, while the lips of the sulcus are devoid of spines in the spinous area, and the sulcus does not terminate in a calyculate ridge at the end of the hemipenis. My notes state that there is only one basal hook or spine, while I have described *mandarinus* as having two hooks. Too much weight should not be placed on this character because the basal hooks are not clearly differentiated from the adjacent enlarged spines in *mandarinus* and *perlacea* hemipenes.

*Distribution*.—*E. perlacea* is known only from the type locality, in Szechwan.

*Material examined*.—I have seen the type specimen, in the U. S. National Museum.

*Remarks*.—Stejneger considers the Japanese *Elaphe conspicillata* to be the nearest relative of *perlacea*, but I believe that *mandarinus* holds this position, a conviction based on the following points:

- a. The hemipenis of *perlacea* is strikingly like that of *mandarinus*. Unfortunately, I have no material of *conspicillata* to dissect, so this basis for argument cannot be carried to the limit.
- b. The patterns of *perlacea* and *mandarinus* persist throughout life, but adult *conspicillata* does not retain its juvenile coloration.
- c. The pattern of *perlacea* is more readily derived from that of *mandarinus* than from the (juvenile) *conspicillata* pattern.
- d. The proximity of the ranges of *perlacea* and *mandarinus* contrasts strongly with the relatively remote isolation of *conspicillata* and makes it probable that the two former species are the more closely allied.
- e. The distribution of *conspicillata* indicates a northern, that of *mandarinus* and *perlacea*, a southern origin. One would therefore expect *perlacea* to be more closely related to *mandarinus* than to *conspicillata*.

#### 66. *Elaphe porphyracea porphyracea* (Cantor)

Figure 55

- Coluber porphyraceus* Cantor, 1839, Proc. Zool. Soc. London, p. 51 (type locality, "Mishmee Hills," Assam).—Anderson, 1879, Zool. Res. W. Yunnan, p. 812 (Tengyueh and Husa, Yunnan).—Boulenger, 1894, Cat. Snakes Brit. Mus., II, p. 34 (part).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 120 (part: Tali, Yunnan, 2000-2600 meters).—Werner, 1924, Denkschr. Acad. Wiss. Wien (math.-natur.), XCIX, p. 48 (between Yungning, Yungpeh and Likiang, Yunnan).
- Coronella callicephalus* Gray, 1853, Ann. Mag. Nat. Hist., (2) XII, p. 390 (type locality, Khasya, Assam).
- Simotes Vaillanti* Sauvage, 1877, Bull. Soc. Philom. Paris, (7) I, p. 107 (type locality, China) (also described in L'Institut, journ. universal sci., 30 Aug. 1876).
- Elaphe porphyracea* Stejneger, 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 105 (part).—Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 58, fig. 18 (Yenchinghsi of Opian Hsien, Szechwan, 1040 meters).

*Ablabes porphyraceus* Annandale, 1911, Rec. Ind. Mus., VI, p. 217 (Lungchwan or "Mong Wan," Yunnan, 3100 feet).

*Elaphe porphyracea pulchra* Schmidt, 1925, Amer. Mus. Novitates, No. 175, p. 3 (type locality, 20 miles north of Yunnanfu); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 528, fig. 16 (amplified description of type; paratypes recorded from Yunnanfu).—Pope, 1929, LVIII, p. 441 (validity of *pulchra* discussed).

*Elaphe porphyracea porphyracea* Schmidt, 1927, l.c. (Tengyueh, Yunnan.)

*Description*.—Upper labials 7 or 8; preoculars single; postoculars 2; anterior temporals 0 or 1; posterior temporals 2; scales smooth, 19-17, rarely 19-18; ventrals in two males 177-198, in five females 181-196; subcaudals in two males 54, in five females 48-56; dorsal saddles 12 to 15 on body, 3 to 4, rarely none, on tail; total length of males 784 and 583, of three females 815, 302 and 289 mm. (Description based on three specimens from Tengyueh and the type and paratypes of *pulchra*.)

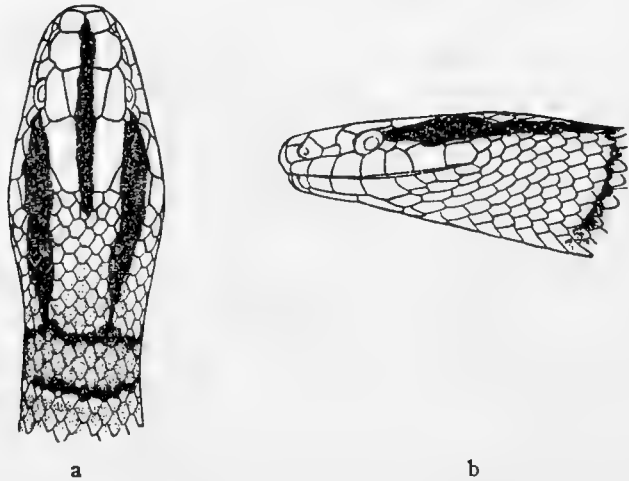


FIG. 55. *Elaphe porphyracea porphyracea*.  $\times 1\frac{3}{10}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 17705 from 20 miles north of Yunnanfu.

Instead of being red with black-edged, red-centered saddles, juvenile specimens of *porphyracea* are yellowish with solid black saddles outlined in dull white. The saddles of the adult are also more or less distinctly outlined with white. (Compare Wall and Evans, 1901, p. 611; Wall, 1909, p. 345, and Venning, 1910, p. 337.)

Table XXXIV gives data on additional Chinese material, the figures in parentheses representing the number of specimens involved.

I have definitely determined that, in all the seventeen Chinese specimens already treated, Roux's Tungchwan example, on which I have incomplete data, possibly excepted, the paired longitudinal lines are absent (or, at least, very incomplete) anteriorly, a condition found in Cantor's type (see his original description given below). This is also true of four specimens from the Southern

TABLE XXXIV. VENTRAL AND SUBCAUDAL COUNTS OF *ELAPHE PORPHYRACEA* *PORPHYRACEA* FROM YUNNAN AND SZECHWAN

Locality	Sex	Ventrals	Subcaudals	Material or Reference
Husa . . . . .		192	54	Anderson, 1879, p. 813
Tengyueh . . . . .		(2)195-197	(2)55-57	Anderson, 1879, p. 812
Yunnan . . . . .		193	64	specimen in British Museum (probably from southwest- ern Yunnan)
between Yungning, Yungpeh and Likiang.		(2)184-188	(2)54-55	Werner, 1924, p. 48
Tungchwan . . . . .	♀	188		correspondence from Roux
Tungchwan . . . . .		191	55	specimen in British Museum
Kutsing . . . . .		194	54	specimen in British Museum
Yenchinghsi . . . . .		193	61	Chang, 1932, p. 60

Shan States described by Wall and Evans in 1901 (p. 611) and the following material, all of which I have examined:

Two series from Mogok and an individual from the Chin Hills in the British Museum.

One example from northern Siam in the Malcolm Smith Collection kindly shown me by Dr. Smith.

Two specimens from the Eastern Himalayas in the Senckenbergisches Museum, Frankfurt.

Three from Yunnanfu in the Museum of Comparative Zoölogy.

Judging by Sauvage's description of the type of *vaillanti*, it has complete longitudinal lines but examination of his original specimen in Paris shows that these lines are not only indistinct anteriorly but absent on the neck, and I am therefore placing *vaillanti* in the synonymy of typical *porphyracea*. David collected in both eastern and western China and might have secured the individual in question anywhere along his route.

Typical *porphyracea*, in addition to possessing a less completely lineate pattern than *nigrofasciata*, has a greater number of dorsal saddles than that form. As far as I am able to determine, *porphyracea porphyracea* has from 12 to 17, *nigrofasciata* from 9 to 12 dorsal saddles. Judging by the description of Venning (1910, p. 337), there is, in Indian material, a strong tendency for the posterior saddles to break up into separate spots or circles. This is also noticeable to some degree in Yunnan specimens (Werner, 1924, l.c.) but scarcely evident in the Fukien series of *nigrofasciata* described under that form.

A comparison of the data enumerated in the table with those given by

Schmidt (1927, pp. 528 and 529) in describing the subspecies *pulchra*, shows at once that the ventral counts of *porphyracea* in Yunnan are very erratic and variable within a small numerical range, but these variations are entirely uncorrelated with geographical distribution. The color distinctions discussed by me (1929, p. 441) do not hold good either, and therefore *pulchra* must go in synonymy. This same conclusion was arrived at by Werner in 1926 (p. 143) and by Chang in 1932 (p. 61).

The original description follows:

Bright porphyry-red, with black transverse lines edged with white, the posterior portion of the body with two black parallel dorsal lines; beneath light yellow. Ventrals 213. Subcaudals 64.

*Distribution*:—Typical *porphyracea* is known from the following Chinese localities:

Szechwan: Yenchinghsi in Opie Hsien.

Yunnan: Lungchwan; Husa; Tengyueh; Tali; between Yungning, Yungpeh and Li-kiang; Tungchwan; Kutsing; 20 miles north of Yunnanfu; Yunnanfu.

Distributed southward from Yunnan into northern Siam and westward across Burma and Assam to the Eastern Himalayas. Annandale (1905, p. 175) has recorded it from the Andaman Islands.

Judging by Hubrecht's (1887, p. 5 and Col. Pl.) beautiful illustration, the Sumatran snake commonly identified as *porphyracea* (de Rooij, 1917, p. 99) represents still a different form, probably a distinct species. It is likely that the authentic Malay Peninsular record of Smith, 1930, p. 48, is based on an example of the snake found on Sumatra.

*Habits and Habitat*:—Wall (1925, p. 812) describes *porphyracea* in Burma as "a hill snake occurring usually above about 3000 feet." The Yunnan and Szechwan records in general fully confirm this statement.

I found a rat in the stomach of an individual from the Eastern Himalayas in the Senckenbergisches Museum, Frankfurt.

A specimen killed in the Southern Shan States before June 15 held 5 eggs still in early stages of development (Wall, 1926, p. 562).

*Material examined*:—I have examined the following Chinese specimens: 1 each from Kutsing, Tungchwan and Yunnan, in the British Museum; the type of *Simotes vaillanti*, in the Paris Museum; 3 from Yunnanfu, in the Museum of Comparative Zoölogy; the type and 3 paratypes of *pulchra*, and 3 specimens from Tengyueh, in the American Museum.

*Remarks*:—The data given above and those recorded under *porphyracea nigrofasciata* below, prove beyond a doubt that two geographically distinct color forms of *porphyracea* exist in China, the one confined to the southeast, the other found only in Szechwan and Yunnan. From a zoögeographical point

of view, the ranges of these subspecies are very reasonable ones. Although I have no real evidence of intergradation, I have treated these two forms subspecifically rather than otherwise simply because the two distinguishing characters are color differences of the type that would readily lend themselves to intergradation. Moreover, records from regions where intermediates would be expected to occur are lacking.

67. *Elaphe porphyracea nigrofasciata* (Cantor)

*Psammophis nigrofasciatus* Cantor, 1839, Proc. Zool. Soc. London, p. 53 (type locality, "Singapore").

*Coluber porphyraceus* Boulenger, 1899, Proc. Zool. Soc. London, p. 165 (Kuatun, Fukien) (not of Cantor, 1839).

—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 28 (Chekiang and Fukien) (not of Cantor, 1839); 1916, XLVII, p. xiv (Fukien) (not of Cantor, 1839).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 120 (part: Lofaoshan and Lungtou, Kwangtung, about 600 and 750 meters).

*Elaphe porphyracea* Stejneger, 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 105 (part).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 443 (Hainan) (not of Cantor, 1839).

*Simotes vaillanti* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 27 (Ningteh and Yungchun, Fukien) (not of Sauvage, 1877).—Roux, 1919, Rev. Suisse Zool., XXVII, p. 63 (this record based on a specimen from Ningpo region, according to correspondence received from Roux) (not of Sauvage, 1877).

*Elaphe porphyracea porphyracea* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 440 (Chungan Hsien, Yenping and Futsing Hsien, Fukien) (not of Cantor, 1839).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 86 (Lohsiang, Kwangsi) (not of Cantor, 1839).

*Elaphe porphyracea sikiangensis* Mell, 1929, Lingnan Sci. Journ., VIII, p. 209 (type locality, Suliukuan, Lofaoshan, Kwangtung, about 600 meters—type thus labeled in Berlin Museum).

*Description*.—Upper labials 8; preoculars single; postoculars 2, very rarely 1; anterior temporals single; posterior temporals 2, very rarely 3; scales smooth, in 19 rows on the neck and at midbody, and 17 before the vent; ventrals in males 189-207, females 199-204; subcaudals in males 59-66, females 64-69; dorsal saddles 9 to 10, rarely 11 on body, 3, rarely 4 on tail; males from snout to vent 733, 723, 715, 711, 710 and 678, females 742, 715, 704, 690, 651 and 287 mm. (Description based on twelve specimens from Chungan Hsien.)

Table XXXV gives data on additional material, the figures in parentheses representing the number of specimens involved.

With the exception of the specimens from the Ningpo region, I have determined that all the material listed in the table has complete or nearly complete longitudinal lines anteriorly as well as posteriorly. Unfortunately, I have no information on the distribution of these lines in the Ningpo region examples.

The original description of the type specimen, a juvenile, follows:

Light reddish-yellow above, with broad transversal black bands, and with two barbed dorsal lines of the same colour; the interval between these dorsal lines dotted with black; the abdominal surface whitish. Ventrals 245. Subcaudals 75.

The almost entirely spinous hemipenis ends opposite the eleventh subcaudal plate. It is furnished with a semicircular disc, a large papilla-like

TABLE XXXV. VENTRAL AND SUBCAUDAL COUNTS OF *ELAPHE PORPHYRACEA NIGROFASCIATA* FROM CHINA AND FORMOSA

<i>Locality</i>	<i>Sex</i>	<i>Ventrals</i>	<i>Subcaudals</i>	<i>Material or Reference</i>
?		215	76	type of <i>Psammophis nigrofasciatus</i>
Hainan.....	♂	(2)198-202	(2)75-79	Schmidt, 1927, p. 443
Lofaoshan.....	♂	195	72	type of <i>sikiangensis</i>
Lohsiang.....	♂ + ♀	(6)195-215	(6)65-74	Fan, 1931, p. 87
Futsing Hsien....	♂	198	65+	Pope, 1929, p. 441
Yenping.....	♂	192	64	Pope, 1929, p. 441
Kuatun.....		(4)191-198	(3)61-66	specimens in British Museum (see Boulenger, 1899, p. 165)
Fukien.....		199	66	specimen in British Museum
Ningpo region....	♂	183	63	Roux's correspondence
Ningpo region....	♂	194	66	Roux, 1919, p. 63 and correspondence
Formosa.....	♂	(4)203-214	(4)61-75	Maki, 1931, p. 81
Formosa.....	♀	(1)204	(1)65	Maki, 1931, p. 81

structure, and small frills at its apex, these three structures occupying the entire width of the organ. Two pairs of spines or hooks arise a short distance distal to the base of the hemipenis, the first or larger pair slightly proximal to and nearer the sulcus than the second. Immediately distal to this second pair, four enlarged spines extend in a transverse row, and they, in turn, are succeeded by numerous smaller ones set in more or less regular longitudinal series. Save for a gradual reduction in size, these numerous spines continue unchanged toward the end of the organ near which they merge into a greatly reduced, inconspicuous, calyculate area which is most extensive on the side of the sulcus opposite the apical disc. The proximal calyces have stiff, scalloped edges gradually becoming soft distally. The sulcus is conspicuous throughout, its well-developed lips bearing minute or small spines as far as the origin of the calyculate area, but beyond this they bear structures similar to those present on the adjacent walls. Proximal to, and around the basal hooks, the hemipenis is beset with minute spines. (Description based on a specimen from Chungan Hsien.)

Probably not much weight should be placed on the exact arrangement of

the basal hooks and adjacent enlarged spines since variations are certain to occur.

The hemipenis of *E. p. nigrofasciata* is unique in structure and has little or no resemblance to that of other allied Chinese snakes.

*Distribution*.—This form of *porphyracea* is known from the following localities in China:

Hainan: Nodua region.

Kwangtung: Lofaoshan and Lungtou.

Kwangsi: Lohsiang.

Fukien: Yungchun; Futsing Hsien; Ningteh; Yenping; Chungan Hsien (including Kuatun).

Chekiang: Ningpo region.

The addition of Formosa to the above completes the list of the places where *nigrofasciata* occurs. It has not been discovered in Tongking.

*Habits and Habitat*.—The twelve Chungan Hsien examples of this snake described above were taken without exception in the high mountains about Sanchiang and Kuatun. Other records (Mell, 1922, p. 120, about 600-750 meters; etc.) confirm its preference for a mountain forest habitat, but its presence in the Nodua region of Hainan proves that it descends to relatively low altitudes as well.

The stomachs of two Chungan Hsien individuals contain small mammal remains.

A specimen of *nigrofasciata* handled by me at Nodua was extremely docile and could not be persuaded to bite or even assume a defensive attitude, while one secured at Sanchiang was anything but docile for it struck viciously when annoyed.

*Material examined*.—I have seen the following material: the type from "Singapore," 4 specimens from Kuatun and 1 from Fukien, in the British Museum; the type of *sikiangensis* from Lofaoshan, in the Berlin Museum; 1 example from Lohsiang, in the Museum of Comparative Zoölogy; and 2 from Hainan, 1 from Futsing Hsien and 14 from Chungan Hsien, in the American Museum.

*Remarks*.—Cantor's type of *Psammophis nigrofasciatus* certainly was not collected at Singapore (Smith, 1930, p. 48). As explained under typical *porphyracea*, Smith's data are substantiated by Hubrecht's figure of a Sumatran specimen. On the other hand, the striking resemblance of specimens from southeastern China to the type in question leaves but little doubt that it actually came from China and I therefore suggest eastern China for the type locality. The relationship of *nigrofasciata* to *porphyracea porphyracea* is discussed under the latter.

68. *Elaphe prasina* (Blyth)

*Coluber prasinus* Blyth, 1854, Journ. Asiat. Soc. Bengal, XXIII, p. 291 (type locality, Assam).—Annandale, 1911, Rec. Ind. Mus., VI, p. 218 (Pupiao, Yunnan, 4600 feet).—Parker, 1925, Ann. Mag. Nat. Hist., (9) XV, p. 301 (Bao-Ha, Tongking, 250 feet).

*Gonyosoma gramineum* Guenther, 1864, Rept. Brit. India, p. 294, Pl. XXIII (type locality, probably Khasya).—Anderson, 1879, Zool. Res. W. Yunnan, p. 824 (Bhamo, Upper Burma).

*Description*.—Loreal uniformly present; upper labials 9, 4th to 6th entering orbit; preoculars single, rarely divided; postoculars 2; anterior temporals 2, rarely 1; posterior temporals 2; scales 19-17-15, smooth or keeled; ventrals 191-209, with lateral keels; subcaudals 91-111; anal divided or entire. Color green above, upper lip and ventrum yellowish or greenish white, save for a narrow light band alongside of belly; young specimens have more or less distinct, chevron-shaped, black bands across the back, especially evident anteriorly and sometimes persisting in varying degrees of intensity even to maturity.

The foregoing description is a composite one based on ten specimens in the British Museum from various localities, Blyth's original description, and material described in the following references: Wall, 1909, p. 346; 1910, p. 825; 1925, p. 812; and Venning, 1910, p. 337. It should be remarked that the real subcaudal range is probably 100-111, there being only one record of its falling below 100 and that may well be based on a broken tail.

This species attains a total length of 1300 mm.

The hemipenis is spinous proximally, calyculate distally, the two areas thus characterized being about equal in extent. The first proximal spines are the smallest, but in general they are uniform in size and merge into the scalloped calyces, the first few of which have spine-like scallops. The lips of the sulcus are not raised, bear small spines in the spinous area, and calyces in the calyculate area. (Description based on specimen "b" of Boulenger, 1894, p. 59, from the Khasi Hills.)

*Distribution*.—*E. prasina* has been found in Yunnan at Pupiao, Imen Hsien and Wutingchow. It is thus seen to extend its range well across this province, while its occurrence in Tongking may be taken as evidence that it is to be expected in southern Yunnan also. I know of only these three Chinese records, however.

Distributed from the Eastern Himalayas through Assam, the Chin and Kachin Hills, and the North and South Shan States into Tongking. Smith (1930, p. 47) includes it in the fauna of the Malay Peninsula.

*Habits and Habitat*.—Wall (1925, p. 812) says, "This is a hill species occurring above about 4000 feet," while its presence on the Yunnan plateau proves that it ranges to at least 6000 feet in China. However, it may descend to an altitude of 500 feet in Assam (Wall, 1909, p. 618, and 1910, p. 825) and 250 feet in Tongking (Parker, 1925, p. 301).



Wall (1925, l.c.) reports a hatchling measuring 315 mm. killed between July and October in the Kachin Hills.

*Material examined*.—In addition to the specimens listed by Boulenger (1894, p. 59), I have seen, in the British Museum, one specimen from each of the following localities: Wutingchow and Imen Hsien, Myitkyina, Maymyo and Bao-Ha.

69. *Elaphe radiata* (Schlegel)

Figure 56

*Coluber radiatus* Schlegel, 1837, Phys. Serp., II, p. 135, Pl. v (Java, Sumatra and Cochin-China; Java hereby suggested as the type locality).

*Compsosoma radiatum* Duméril and Bibron, 1854, Erp. Gén., VII, p. 292 (China).

*Spilotes radiatus* Müller, 1878, Verh. Naturf. Ges. Basel, VI, p. 600 (Lilong, Kwangtung).

*Elaphe radiata* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 446 (Yuankiang, Yunnan).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 90 (Lohsiang, Kwangsi).

*Description*.—Upper labials 8 or 9; preoculars single; postoculars 2 or 3; anterior temporals 2; posterior temporals 2 or 3; scales keeled, with the complete formula 21-19-17; ventrals in males 228-231, female 244; subcaudals in males 97-101, female 95; length of males 1043+286 and 1040+290, female 1158+283 mm. Color yellowish brown above with two wide, black middorsal bands and two narrow lateral ones beginning a short distance behind head and disappearing about midbody; a black band across occiput and three narrower ones radiating from eye; ventrum uniform. (Description based on two specimens from Lohsiang and one from Yuankiang.)

A female in the British Museum from southern Fukien has 245 ventrals and 92 subcaudals, while a specimen of the same sex from Kwangtung now preserved in the Basel Museum has 244 and 89 ventrals and subcaudals, respectively. A Lilong male, also in the Basel Museum, has 231 ventrals, 95 subcaudals.

According to Wall (1914, pp. 207 and 208), the adults "usually vary from five to six feet" in length and show no sexual dimorphism in size.

The hemipenis extends to the eleventh to twelfth subcaudal plates. It is spinous proximally, calyculate distally, the areas thus differentiated being about equal in extent. The spines are at first very small, but rapidly attain their maximum length of 3 mm., free end measurement. They are pointed, slender, slightly curved and very numerous. In spite of having stiff but blunt spine-like scallops proximally, the calyces are rather abruptly set off from the spines by a line extending straight across the organ. The calyces are gradually reduced in size, their scallops becoming shallower and less spine-like toward the end of the hemipenis. The sulcus is conspicuous throughout, its well-developed lips bearing small spines in the spinous region and dense calyces in the calyculate area. The lips are especially conspicuous in the transitional

zone between spines and calyces. (Description based on the 1330 mm. male from Yuankiang.)

The hemipenis of a male from an unspecified locality differs from the foregoing description in having only stiff-scalloped calyces. Although the Yuankiang male appears to be mature, the difference cited might possibly be due to age.

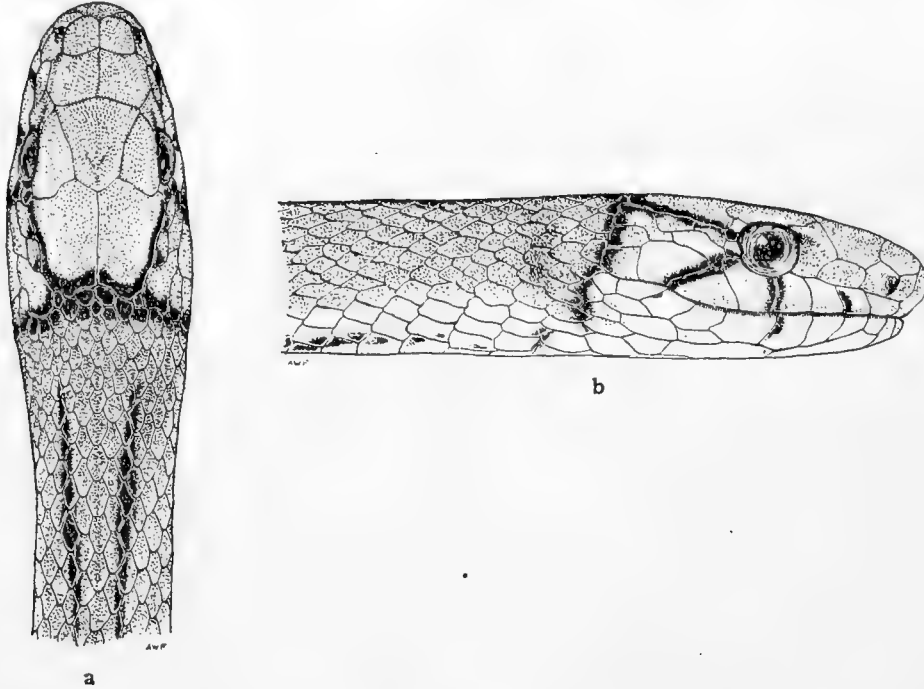


FIG. 56. *Elaphe radiata*.  $\times 1\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 35237 from Yuankiang, Yunnan.

**Distribution:**—In China, *Elaphe radiata* is known only from the following localities:

Fukien: the southern part.

Kwangtung: the region of Wuyung and Namkong and also that west of Canton; Lilong.

Kwangsi: Lohsiang.

Yunnan: Yuankiang.

Judging by Wall's 1925 (p. 813) and 1926 (p. 562) records for Upper Burma, *radiata* is to be expected in western as well as southern Yunnan. In fact, Boulenger long ago (1888, p. 598) reported it from Bhamo.

Distributed from Orissa and the Eastern Himalayas eastward across southern China and southward through the peninsula of southeastern Asia into the Malay Archipelago.

**Habits and Habitat:**—*Elaphe radiata* "is a common species throughout

Burma in the plains, and ascends the hills up to about 5000 feet" (Wall, 1925, l.c.), but Mell (1922, p. 121) found it only up to 200 meters in Kwangtung. The Yuankiang specimen described above proves that *radiata* occurs at least to 1500 feet in Yunnan, while Fan's (1931, p. 90) Lohsiang record certainly substantiates this datum.

This species frequents gardens, fields near jungles and other relatively open situations, while it swims well (Wall, 1914, p. 207, and Smith, 1914, p. 95). Guenther (1864, p. 244) states that it is equally nocturnal and diurnal.

The food of *radiata* is stated in a general way by Guenther (1864, l.c.) to consist of "rats, birds, lizards, and frogs," but Wall (1914, l.c.) describes it as feeding exclusively on mammals and (1903, p. 92) records finding the newly-born young of some mammal in a Hongkong specimen.

Wall (1914, l.c.) has found from 5 to 12 eggs in gravid females, and these he has secured during April, May, June and July. The largest egg seen by him measured 52 mm. in its long diameter. The species is apparently oviparous.

Both Wall (1914, p. 208) and Smith (1914, l.c. and Pl.) have described in detail how *radiata*, when annoyed, flattens its neck vertically, throwing it into an S-shaped loop, opens its mouth and remains thus on the alert ready to defend itself vigorously against attack. The black lateral bars brought suddenly into view by this behavior may act as a warning to enemies. Mell (1929, p. 256, etc.) has given an interesting comparative discussion of the defensive tactics of this and other Asiatic species.

*Material examined*:—I have seen the following Chinese specimens: 1 from southern Fukien, in the British Museum; and 1 from Yuankiang, in the American Museum. K. P. Schmidt kindly examined for me 2 Kwangtung specimens in the Museum d'Histoire Naturelle, Basel.

#### 70. *Elaphe rufodorsata* (Cantor)

Plate X, I, J, K, L and M

*Tropidonotus rufodorsatus* Cantor, 1842, Ann. Mag. Nat. Hist., IX, p. 483 (type locality, Chusan Island).

*Ablabes sex-lineatus* Duméril and Bibron, 1854, Erp. Gén., VII, p. 324 (type locality, China).

*Coluber rufodorsatus* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 89 (part: Chusan and near Ningpo, Chekiang; Chekiang).

*Coronella sexlineata* Jan and Sordelli, 1865, Icon. Ophid., Livr. 14, Pl. VI (type of *A. sex-lineatus* figured).

*Simotes Herzi* Boettger, 1886, Zool. Anz., IX, p. 519 (type locality, hills near Shanghai).

*Ablabes rufodorsatus* Boulenger, 1890, Ann. Mag. Nat. Hist., (6) V, p. 138 (Peiping).

*Elaphe rufodorsata* Stejneger, 1907, Herp. Japan, p. 310, figs. 269-271 (Korea).

*Description*:—Upper labials 7, rarely 8; preoculars single; postoculars 2; anterior temporals normally 2, occasionally 1; posterior temporals normally 3, sometimes 1 or 4; scales smooth, with the complete formula 21-19-17; ventrals in fourteen males 163-172, in twenty-one females 173-182; subcaudals in fourteen males 56-63, in twenty females 49-53; total length of largest male 555,

largest female 755 mm. (Description based on thirty-five specimens from Ningkwo and Wuhu.)

Sowerby (1930, p. 14) has described a living specimen as follows:

It is of a rich reddish-brown colour, with four rows of dark longitudinal spots on the upper parts, which soon coalesce to form continuous longitudinal rays extending the whole length of the body to the tip of the tail. The head has a peculiar V-shaped, dark-edged pattern, the apex of the V pointing forward, the arms extending back on to the neck to connect up with the inner (upper) two rows of dots, and having between them a *fleur-de-lis* on the back of the head. There is also a dark brownish line from the nose, through the eye, to the angle of the mouth, where a short break occurs between it and the first oblong spot of the outer or lateral row of dots. The under surface of the body is of an orange-brown colour with irregular black dots.

Table XXXVI, based on material in the American Museum, shows to what a marked degree sexual dimorphism in size is developed in *rufodorsata*.

TABLE XXXVI. SEXUAL DIMORPHISM OF *ELAPHE RUFODORSATA* FROM HOPEI AND SHANTUNG

Locality	Sex	Total No. in Series	Length of Four Largest in Millimeters			
Peiping and Western Hills.....	♂	28	523 + 132	519 + 127	513 + 125	509 + 123
	♀	46	708 + 128	691 + 127	682 + 117	662 + 115
Tsinan and region.....	♂	19	527 + 133	527 + ?	523 + 120	522 + ?
	♀	43	745 + 142	736 + 121 +	713 + 125	710 + 133

The hemipenis extends to the thirteenth subcaudal plate. It is spinous save for a short area of soft, papilla-like structures suggestive of poorly formed calyces at its extremity. About twenty-two enlarged, compressed, curved spines lie just distal to the base of the organ and are continuous with the much smaller ones that extend on to the area of papilla-like structures. These relatively small spines, arranged in more or less distinct, longitudinal rows, are mounted on longitudinal ridges distally. The sulcus is conspicuous, its lips spinous except at their distal termination. Proximal to the enlarged basal spines, the hemipenis is beset with numerous minute ones. (Description based on a specimen from Tsinan.)

*Distribution*.—This species has been collected at the following localities in China:

Fukien: (no specific locality).

Kiangsi: Lushan.

Chekiang: Chusan Island; Ningpo and region; Hangchow; Tunglu.

Hupei: Hankow.

Anhwei: Ningkwo; Wuhu; Chuchow.

Kiangsu: Shaweishan; Shanghai and region; Kunshan and vicinity; Soochow; Chinkiang; Nanking.

Shantung: Tsinan and region.

Hopei: Tientsin; Peiping and vicinity; Western Hills; Shanhaikwan.

From Hopei, its range extends northeastward through Manchuria to the sea and as far as the Transbaikial region to the northwest (Stejneger, 1907, p. 312; Nikolsky, 1916, p. 121; Emelianov, 1929, p. 49, and Sowerby, 1930, l.c.).

It is common in Korea but has been taken only once on Formosa (Maki, 1931, p. 87).

Jacot (1931, p. 42) mentions Szechwan as part of the range of *rufodorsata* but on what authority I do not know. Boulenger's (1894, p. 44) Hoihow record has already been disposed of by Stejneger (1907, p. 318) and I am unable to identify Zarevskij's (1915 (p. 57) Hankow. Probably it is in Hopei.

*Habits and Habitat*:—All observers agree that *rufodorsata* is semi-aquatic in habits, frequenting marshes, flooded fields, and the borders of ponds, lakes, canals, creeks and rivers. It is an agile swimmer and diver (Emelianov, 1929, p. 49). Wherever found, it seems to be present in great numbers. Sowerby (1930, l.c.) describes it as "particularly plentiful in the marshes round Tientsin"; Boring, Liu and Chou (1932, p. 61) as "the commonest water snake of Peiping"; Maki (1931, p. 87) as the "commonest snake in Korea"; Stanley (1914, p. 28) as "very common in the creeks around Quinsan" (Kunshan), while I encountered no fewer than six individuals during a 45-minute, daytime stroll through flooded fields near Wuhu. It is also abundant in the Far Eastern District (Emelianov, 1929, pp. 49 and 50).

*E. rufodorsata* feeds on frogs, loaches and eels. Guenther (1864, p. 238) mentioned finding a frog in one stomach, while Chang and Fang (1931, p. 271) make the general statement that it feeds on "small frogs such as *Microhyla* and *Rana limnocharis*." Maki (1931, p. 87) likewise observes that it eats frogs. Examination of Chinese material in the American Museum gives the following results:

Eight stomachs contained frog remains.

Four stomachs contained remains of *Rana limnocharis*.

Five stomachs contained remains of non-spinous loaches.

One stomach contained remains of *Fluta alba*.

The stomach contents of the ten specimens reported by me (1929, p. 443) have been incorporated in the above data.

A Tientsin individual kept in captivity by Sowerby (1930, l.c.) "gave birth to some eight or ten young ones about 5 inches in length." Female snakes taken in the Far Eastern District at approximately 44° N. Latitude produced

the same number of offspring on September 25. These hatchlings measured 200 mm. and fed on cockroaches (Emelianov, 1929, p. 51). Ten females in the American Museum from Peiping, the Western Hills and the region of Tsinan contain, respectively, 21, 16, 16, 14, 12, 12, 11, 10, 7, and 4 eggs. A lot of fourteen Peiping embryos, obviously on the point of birth and devoid of egg-teeth, range in total length from 193 to 214 mm. These data on the American Museum material include those given by me in 1929 (l.c.). The total number of females involved was then stated to be eleven, but it actually should have been given as nine. The average of 12.4 is, however, correct for the nine as then recorded.

Emelianov (1929, p. 50) observes that breeding pairs have their heads turned in opposite directions.

*Elaphe rufodorsata* is apparently diurnal (Boring, Liu and Chou, 1932, l.c.). It is aquatic enough to lie submerged under water frequently when in captivity (Chang and Fang, 1931, l.c.). It sometimes bites viciously during capture (Emelianov, 1929, p. 49) but, in Anhwei, I found it to be a very mild-tempered snake and have stated in my field notes that it did not show any fight or even offer to bite. I also record encountering one busily swallowing a frog, moving it a short distance, and leaving it as intent on devouring its victim as when first discovered.

*Material examined*.—Among numerous others, I have seen the following specimens from China: 1 from Hankow, in the Senckenbergisches Museum, Frankfurt; and 1 from Soochow and 7 from Tunghu, in the Museum of Comparative Zoölogy.

*Remarks*.—The ovoviviparous habits of this *Elaphe* may have been forced upon it by its aquatic habits as suggested by Sowerby (1930, l.c.). This argument, however, loses some of its weight when we recall that the vast majority of species of *Natrix* found in eastern Asia are both semi-aquatic and egg-laying.

#### 71. *Elaphe schrenckii anomala* (Boulenger)

Figure 57

- Coluber anomalus* Boulenger, 1916, Ann. Mag. Nat. Hist., (8) XVII, p. 243 (type locality, Chihfeng, Jehol).  
*Elaphe schrencki besenbruchi* Müller, 1923, Zool. Anz., LVII, p. 150 (type locality, Tsingtao, Shantung).  
*Elaphe schrenckii* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 81 (part: Hsinglungshan, Hopei).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 526 (Hsinglungshan, Hopei) (not of Strauch, 1873).  
 —Pope, 1929, LVIII, p. 436 (Western Hills, Hopei) (not of Strauch, 1873).—Tchang, 1932, Bull. Fan Mem. Inst. Biol., III, p. 13 (Peiping) (not of Strauch, 1873).  
*Elaphe anomalus* Sowerby, 1930, Natural. Manchuria, IV, p. 17.  
*Coluber schrencki* Zarevskij, 1930, Ann. Mus. Zool. Acad. Sci. URSS, XXXI, p. 215 (Peiping) (not of Strauch, 1873).  
*Elaphe schrenckii* Boring, Liu and Chou, 1932, Handb. N. China Amphib. Rept., p. 63, figs. (vicinity of Peiping) (typ. err. for *schrenckii*; not of Strauch, 1873).

*Description*.—Upper labials 8, very rarely 7; preoculars 1 or 2; postoculars

2, rarely 1; anterior temporals 2, rarely 1; posterior temporals 1 to 4; scales keeled, in 23, very rarely 21 rows on the neck and at midbody, 19, rarely 17, very rarely 18 before the vent<sup>1</sup>; ventrals in five males 206-216, in five females 218-222; subcaudals in five males 70-77, in five females 64-72; a few subcaudals sometimes single. (Description based on eleven specimens from Hsinglungshan.)

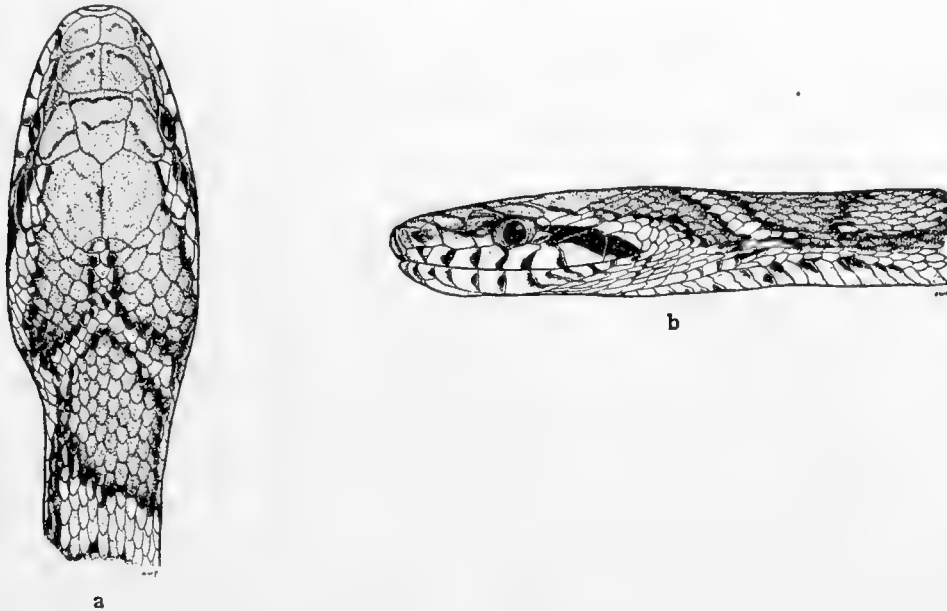


FIG. 57. *Elaphe schrenckii anomala*. x 2. Juvenile head-pattern. a. Dorsal view. b. Lateral view A.M.N.H. No. 21492 from Hsinglungshan, Hopei.

Table XXXVII summarizes data on additional Chinese material, the figures in parentheses indicating the number of specimens involved.

The juvenile pattern of *anomala* differs radically from that of the adult. The young individual (445 mm., total length) in the American Museum, labeled Peiping but possibly from elsewhere, may be described very briefly as follows:

The back is crossed by a series of dark gray, black-edged bands separated by light gray interspaces, each of which has a dark median area. Anteriorly, the dark bands are wide, the interspaces narrow, while posteriorly, bands and interspaces are about equal in width but the black margins of the former are now relatively much wider. Each ventral plate has several gray spots. A dark band arches forward from the eyes and is continued behind them as a postocular stripe.

<sup>1</sup>Schmidt's 1927, p. 526, data notwithstanding.

TABLE XXXVII. VENTRAL AND SUBCAUDAL COUNTS AND DIMENSIONS OF  
*ELAPHE SCHRENCKII ANOMALA* FROM CHINA

Locality	Sex	Ventrals	Subcaudals	Total Length in Millimeters	Material or Reference
Western Hills.	♂	218	70 +	1820 +	Pope, 1929, p. 436
Western Hills.	♀	212	68	1900 (skin)	Pope, 1929, p. 436
Peiping ? . . . .	♂	208	72	445	specimen in American Museum
Peiping . . . . .		(7)209-224	(6)70-77	(6)1134-1755 +	Tchang, 1932, p. 14
Hululi . . . . .	♀	222	68	about 1525	Mus. Comp. Zool. No. 16309
Tsingtao . . . .	♂	214	70	1095	type of <i>besenbruchi</i>

The adult turns almost uniform brown, losing all of this elaborate coloration save the elements enumerated below:

- a. A varying but usually very small remnant of the postocular stripe.
- b. The black edges of the dorsal bands which are, however, generally only evident posteriorly and even there quite weak and indistinct.
- c. A faint trace of the ventral spotting (often entirely absent).

It must be borne in mind that the juvenile markings are retained for some time in *schrenckii*, so only fully grown individuals can be used in studying the pattern of maturity.

In strong contrast to adult *anomala*, when typical or northern *schrenckii* attains maturity, it is a black snake with laterally bifurcating, narrow light bands crossing the back at wide intervals. The belly is punctuated with small, black spots arranged just as in juveniles of both forms, and the head above the mouth is black save for the upper labials, each of which is light anteriorly. I have examined no less than seven of the black individuals, two labeled "Ussuri," one "Amur," one "Kissawitsch," one "Possiet," one Manchuria, while one was collected by Sowerby in Manchuria along the Yalu River about 180 miles from its mouth. Although most of these names refer only to rather extensive regions, they are definite enough to place the range of typical *schrenckii* to the northeast of the localities at which *anomala* has been secured. Pavloff (1926, fig. 9), Emelianov (1929) and Sowerby (1930, Pl. 1) have published photographs of *schrenckii schrenckii*, while Maki's (1931) excellent colored plate (xxxv) illustrates the adult ("normal color phase") and transitional ("dark color phase") patterns of *anomala* from Korea.



The original description of the type specimen, a male, follows:

Snout rounded, scarcely prominent; canthus rostralis very obtuse, loreal region slightly concave; eye rather small, one-third length of snout. Rostral much broader than deep, just visible from above; internasals as long as broad, as long as the præfrontals; frontal as long as broad, two-thirds its distance from the end of the snout, three-fifths the length of the parietals; loreal longer than deep; præocular single, no subocular below it; two postoculars; temporals 2 + 3 or 4; seven upper labials, third and fourth entering the eye; four lower labials in contact with the anterior chin-shields, which are a little longer than the posterior. Scales in 22 rows, dorsals feebly but very distinctly keeled, laterals smooth. Ventrals not angulate laterally, 212; anal divided; subcaudals mostly single, 65. Dark brown above; a large blotch on the neck and a streak behind the eye black; hinder part of body and tail with rather irregular black cross-bars; lower parts white, with greyish spots anteriorly; subcaudals edged with brown. Total length 1770 mm.; tail 250.

The hemipenis extends to the seventeenth to eighteenth subcaudal plates. It is spinous proximally, calyculate distally, the calyculate area half again as extensive as the spinous one. The spines are cylindrical and uniform in size, but some are pointed, others rather blunt. They are about fifty in number, while the first one arises a little distal to the base of the organ but slightly proximal to the others. The relatively uniform calyces become gradually smaller toward the end of the hemipenis, are shallowly scalloped and soft edged throughout, and abruptly separated from the spines by an imaginary line extending straight across the organ. The lips of the sulcus, entirely devoid of spines and bearing only poorly developed calyces in the calyculate area, are very well developed, especially distally. A ridge arises about midway between the termination of the spines and the end of the organ, and runs parallel to and near the sulcus. Between this ridge and the sulcus, the calyces are not developed as far distally as elsewhere. (Description based on a specimen from Hsinglungshan.)

*Distribution*.—*E. schrenckii anomala* is known with certainty to occur at the following Chinese localities:

Jehol: Chihfeng.

Hopei: Hsinglungshan; Peiping; Western Hills.

Shansi: Hululi.

The type locality of *besenbruchi* is Tsingtao, while a typical specimen of *anomala* in the British Museum is labeled "Tsai-Chih, near Hankow," and one in the Museum of Comparative Zoölogy is from the "Yangtze River." In view of the fact that snakes are so often carried about in China, I think it well to await confirmation of the last two records at least. The one for Tsingtao is not surprising and certainly establishes the presence of *anomala* in Shantung if not actually at Tsingtao.

*Habits and Habitat*.—The locality records show that *anomala* occurs on

plains at low altitudes (Peiping) as well as in mountains (Hsinglungshan and Western Hills) in the northern part of its range, while the only reliable record for the southern part is based on a specimen taken at 6000 feet in the mountains of Shansi (Hululi).

Two specimens in the American Museum (Nos. 21486 and 29389) contain the remains of Norway rats.

Although almost nothing is known about the habits of *anomala*, Emelianov (1929, pp. 74-77) has given an excellent account of those of typical *schrenckii*. Among other things, he states that it lays a large number of eggs (13-30) from the middle of July to the middle of August, while the young emerge in September or late August and measure about 300 mm. in total length. Its food consists chiefly of rodents and birds but it will also eat eggs. Sowerby (1930, p. 16) describes *schrenckii* as "the commonest species occurring in the Manchurian forested area as well as on the Yalu river." He has had field experience with both forms, but is here referring solely to the northern or typical one. No locality data accompany Mell's 1929 (p. 74) record of a bird in the stomach of an *E. schrenckii*, so it is impossible to say what form he dissected. Seven eggs, a typical one of which measures about 50 x 25 mm., were brought to our camp at Hsinglungshan between August 6 and 10. An early, unpigmented embryo 90 mm. long proves beyond doubt that these are snake eggs, while their dimensions and those of the embryo give a good idea of the size of the parent. There is little reason to doubt that these are eggs of *anomala*.

*Material examined*.—I have seen the following specimens from China: the type of *Coluber anomalus* from Chihfeng, and 1 specimen from "Tsai-Chih, near Hankow," in the British Museum; 1 without data, in the Berlin Museum; 1 from Hululi, 63 miles southwest of Taiyuan, and 1 from the "Yangtze River," in the Museum of Comparative Zoölogy; 2 from Hsinglungshan, in the U. S. National Museum; 9 from Hsinglungshan, 2 from the Western Hills, and 1 from Peiping, in the American Museum. This Peiping example was presented by Dr. Boring who informs me that some doubt must be attached to the locality.

I have also examined perfectly typical examples of *anomala* from Korea (Seoul).

*Remarks*.—The foregoing treatment has made it clear that the name *anomala* is applied to a snake from Shansi, Shantung, Hopei, Jehol and part of Korea, and that this snake differs markedly in adult color pattern from a north-eastern one found in Manchuria and the region eastward to the sea and called *schrenckii schrenckii*. Certain questions that must inevitably arise have not, however, been answered. The following statements are designed as answers to these questions.

1. The characters upon which *Coluber anomalus* was erected by Boulenger are valueless in distinguishing *anomala* from typical *schrenckii* (Stejneger, 1925, p. 81), but Boulenger's name, nevertheless, is applicable and must be used.

2. I have entirely failed to discover any external structural difference between *anomala* and *schrenckii schrenckii*. The hemipenis of the latter seems to lack the ridge that extends parallel to and near the sulcus in the former, but this apparent distinction requires further study.

3. I have also failed to distinguish between the juvenile color patterns of the two forms involved.

4. Although *anomala* and typical *schrenckii* have perfectly distinct and logical ranges and do not, to my knowledge, intergrade, I have considered it best to use trinomials because only fully mature adults can as yet be separated without taking localities into consideration. When one considers the extensive area in which these forms must be in apposition, it is hard to believe that they do not intergrade in northern Korea and northeastern China. At any rate, I shall await the acquisition of new material with great interest.

As far as my experience and knowledge go, no other species of *Elaphe* demonstrates so well the extent to which two forms (or even distinct species?) can have identical ontogenies. At least, if not identical, the difference between juvenile *anomala* and *schrenckii schrenckii* is certainly anything but obvious.

The synonymy heading this species does not include references to Korean material. (See Stejneger, 1907, p. 313, and Maki, 1931, p. 101.)

## 72. *Elaphe taniurus* Cope

Figure 58

*Elaphis virgatus* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 94 (part: Chekiang).

*Elaphe taniurus* Cope, 1861, Proc. Acad. Nat. Sci. Phila., XII, p. 565 (type localities, Ningpo and Siam).

*Elaphis taniurus* Guenther, 1864, Rept. Brit. India, p. 242.

*Elaphis yunnanensis* Anderson, 1879, Zool. Res. W. Yunnan, p. 813 (type locality, Tengyueh, Yunnan).

*Coluber taniurus* Boulenger, 1890, Ann. Mag. Nat. Hist., (6) V, p. 139 (Western Hills, Hopei).

*Coluber Vaillanti* Mocquard, 1905, Bull. Mus. Hist. Nat., Paris, XI, p. 76 (type locality, Caobang, Tongking); 1905, Bull. Soc. Philom. Paris, VII, p. 319, fig. 2 (amplified description of type).

*Elaphe taniura vaillanti* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 443 (Namfong, Hainan).

*Elaphe taniura taniura* Schmidt, 1927, p. 532 (Ningkwu and Wuhu, Anhwei).

*Elaphe taniura yunnanensis* Schmidt, 1927, p. 533 (Tengyueh, Yunnan; Wanhsien, Szechwan; Shaowu, Fukien; and South China).

*Description*.—Upper labials 9, rarely 8, very rarely 10; preoculars 2, rarely an additional small one; postoculars 2; anterior temporals 2, rarely 3, very rarely 1 or 4; posterior temporals 3, occasionally 4, very rarely 2 or 5; scales feebly keeled, in 25, occasionally 23, rows on the neck, 25, rarely 23, very rarely 24 or 27 at midbody, and 19, very rarely 21 or 23 before the vent; ventrals in seven males 241-252, in thirteen females 245-258; subcaudals in five males 95-109, in eight females 98-111. (Description based on twenty specimens from Chungan Hsien.)

Table XXXVIII gives ventral and subcaudal counts of additional Chinese

material, the figures in parentheses indicating the number of specimens involved.

TABLE XXXVIII. VENTRAL AND SUBCAUDAL COUNTS OF *ELAPHE TÆNIURUS* FROM CHINA

<i>Locality</i>	<i>Ventrals</i>	<i>Subcaudals</i>	<i>Material or Reference</i>
Hainan.....	259	120	Schmidt, 1927, p. 444
Yaoshan.....	(6)248-264	(6)98-123	Fan, 1931, p. 89 (six males)
Wuhu and Ningkwo.....	(15)225-245	(13)84-101	Schmidt, 1927, p. 533
Nanking.....	(7)227-241	(6)93-106	Chang and Fang, 1931, p. 273
Chungking-Hochuan region ..	(8)236-254	(8)102-112	Chang, 1932, p. 64
Opien Hsien.....	(2)243-247	(2)112	Chang, 1932, p. 64
Mt. Omei.....	243	107	Chang, 1932, p. 64
Kiating.....	243	103	Chang, 1932, p. 64
Laolingkung.....	230	104	Barbour, 1912, p. 129
Süchow.....	(2)245-255	(2)112-116	Stejneger, 1925, p. 82
Yulungkung.....	234	111	Stejneger, 1925, p. 82 (No. 66634, female)
Mengtsz.....	239	95	specimen in American Museum
Yunnanfu.....	236		specimen in British Museum
Tengyueh.....	(3)252-258		cotypes of <i>Elaphis yunnanensis</i>
Peiping.....	(2)246-251	(2)102-103	Tchang, 1932, p. 13

In the table, I have given selected data on specimens secured from widely separated localities simply to show how erratic and geographically inconsistent the variations of *tæniurus* are. In eastern China, they seem to be correlated with altitude, but such can scarcely be the case in Hsikang, for a female taken at 11,000 feet has only 234 ventrals! It is certainly true, however, that material from mountainous regions strongly tends to high ventral and subcaudal counts, but as Chang (1932, p. 66) has already remarked, much vexation may be avoided by calling all the Chinese material simply *tæniurus*. The problem presented through the remarkable variations of this species should be dealt with by the appropriate student of general biological problems rather than by the taxonomist interested chiefly in consistent geographical forms.

This snake attains a total length of 2365 mm. on Formosa (Maki, 1931, p. 95).

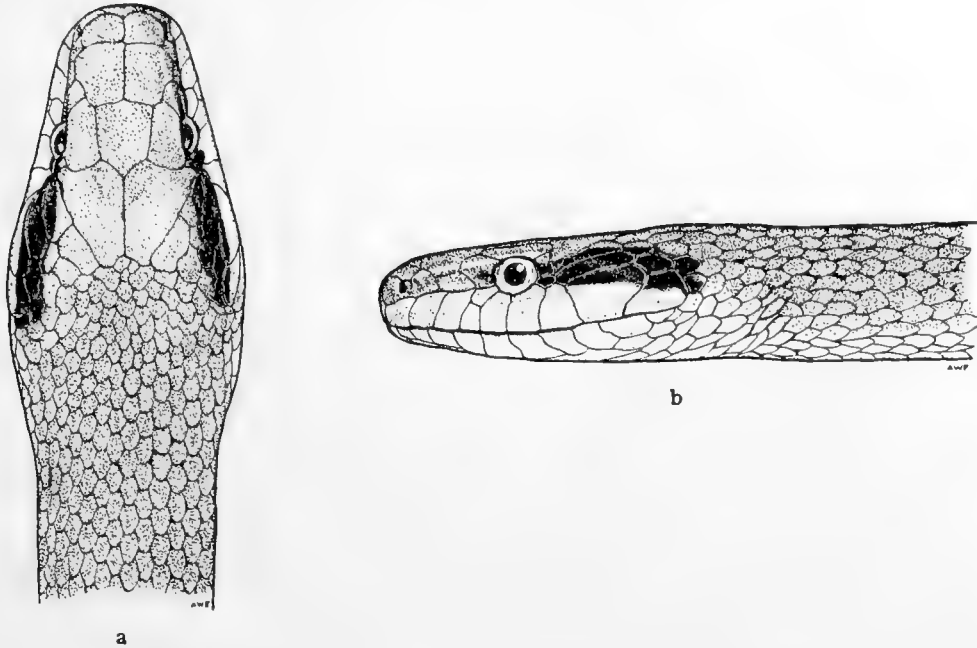


FIG. 58. *Elaphe taniurus*. Nat. size. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 33626 from Chungan Hsien, Fukien.

The original description, based on the two cotypes from Siam and Ningpo, follows:

As in many other serpents of Eastern Asia, the maxillary and mandibular teeth become gradually longer anteriorly. Head slightly distinct, lanceolate, muzzle obtuse. Tail one-fifth the total length, flat beneath. Twenty-five rows of scales, those from the ninth to the sixteenth keeled. Rostral plate broader than high, the labial suture one-third the nasal, less than the prefrontal. Eight superior labials, fourth and fifth bounding the orbit. Seventh much longer than high, bounded above by a long temporal, and by a short one, which also bounds the eighth labial. Postoculars two, superior largest. Preoculars two, as in other species of the genus, the superior very large, its horizontal diameter greater than the length of the loreal. The latter plate much longer than high. Postfrontals large, bent upon the sides. Anterior border of the vertical shorter than the straight, convergent lateral; posterior angle obtuse. Superciliaries large. Occipitals elongate, external borders convergent, bounded by two long temporals. Inferior labials ten, eleven, or twelve. Gastrosteges 232; one divided anal; urosteges 101 pair. Total length of specimen from Ningpo 64 in., tail 13 in.; specimen from Siam 30 in., tail 6 in., 3 lines.

Above, an olivaceous ash, or clay color, more olive anteriorly. A blackish lateral band extends from the tip of the tail, throughout the posterior third of the body, where it extends from the second to the ninth rows of scales, reducing the ground color to a dorsal stripe of three or four scales in width. It is divided by a number of irregular narrow vertical lines, at regular distances. The superior border is prolonged upon the anterior two-thirds of the body

as an irregular, narrow, longitudinal black band, connected with that of the opposite side by similar short transverse bands at distances of four or five scales. Irregular black borders and centres of the median lateral scales, are the only indications of the inferior part of the lateral band anteriorly. Gastrosteges tipped with black anteriorly; the central parts become gradually darker posteriorly, but finally give place to a yellow median band which extends to the tip of the tail. This is bounded by a blackish band on each side, which is separated from that of the sides by another yellow one, which involves the tips of the gastrosteges, and first row of scales. The only marking upon the head is a black postocular vitta, which extends along the upper borders of the labials and no farther, parallel to the commissure of the mouth. Pectus, throat, chin and superior labials yellowish.

Dr. Dunn has very kindly re-examined the cotypes and informed me that both are males with 8 upper labials and preoculars separated from the frontal; the ventral and subcaudal counts of the one from Siam are 235 and 104, of the other, 225 and 93+, respectively.

The hemipenis extends to the twelfth subcaudal plate. It is spinous proximally, calyculate distally, the areas thus differentiated being about equal in extent. The thick, blunt, cylindrical or slightly compressed spines arise somewhat distal to the base of the organ and are uniform in size and structure. Each one is surmounted by a minute, sharp tip. The calyces are soft edged, deeply scalloped and well developed, but somewhat reduced in size distally. They are not uniformly developed throughout but are especially deep and profuse on opposite sides of the hemipenis, one area of maximum development lying adjacent to the sulcus. There are no spines on the lips of the sulcus in the spinous area, but in the calyculate region its lips bear calyces, those of one side much better developed than those of the other save at the organ's extremity where both lips are profusely calyculate. (Description based on a specimen from Tengyueh.)

*Distribution*.—The records of this snake for the Eastern Himalayas, Assam, Burma (Wall, 1923, p. 622), Laos (Angel, 1929, p. 79) and Tongking (Mocquard, 1905, p. 76, and Parker, 1925, p. 305), coupled with numerous additional ones for various southern Chinese localities, prove that it is generally distributed in China at least as far north as the Yangtze Valley. In Szechwan and Hsikang it is found north to Chengtu and west to Batang (Vogt, 1924, p. 339), while its distribution in northeastern China is erratic. Jacot (1923, p. 260) failed to find it in Shantung, but the abundant records for Peiping and the Western Hills prove that it is not rare in parts of Hopei. Evidence of its presence to the northeast of Peiping and in Korea consists of two very old records, one for Korea (Stejneger, 1907, p. 321), the other for Possiet Bay (Strauch, 1873, p. 105), and a recent one for the Yalu River valley (Sowerby, 1930, p. 17), (see also Mori, 1927, p. 141). Its scarcity in these regions is proved by the fact that neither Emelianov (1929, p. 71) nor Maki (1931, p. 96) have new material

to report. It seems to me highly probable that *tæniurus* was carried into northern China by man. Emelianov (1929, p. 72) states that *Elaphe schrenckii* is kept in a domestic state in Manchuria and perhaps *tæniurus* has been or is treated in the same way about Peiping.

*E. tæniurus* is recorded from Formosa by some authors (Maki, 1931, p. 94, Col. Pl. xxxiii) as a distinct subspecies *friesi*, but, in my opinion, Formosan *tæniurus* does not warrant recognition as a good form.

The distribution of *tæniurus* in Siam, and adjacent territory to the east and west, is still quite problematic because it has been so consistently confused with *Elaphe grabowskyi* of the Malay Peninsula and Archipelago. The relationship of these two distinct species is discussed in detail below.

*Habits and Habitat*.—This remarkably successful and widely distributed species has apparently adapted itself to life at all altitudes. Stanley (1914, p. 27) calls it "the commonest snake in Shanghai," while I found it abundant both about Ningkwo in Anhwei and in the high Kuatun-Sanchiang mountains of Fukien. Stejneger (1925, l.c.) records one taken at 11,000 feet near Tatsienlu, and Barbour (1912, l.c.) reports another Hsikang specimen collected at 10,300 feet.

Chang and Fang (1931, l.c.) state that, in Nanking, "This common species lives inside our dwellings and feeds exclusively upon the house rats. The fact that they never prey upon frogs has been confirmed by observing their feeding habits. They are harmless and rather beneficial to man." Stanley (1914, l.c.) also reports that *tæniurus* feeds on rats and inhabits dwellings in Shanghai. One specimen in the American Museum from Tengyueh contains remains of a rat, apparently of the domestic variety.

This powerful snake is slow and deliberate in its movements and relatively docile, readily becoming quite tame. Its marked climbing tendencies (Pope, 1929, p. 445), feeding habits and good disposition probably enable it to thrive in human habitations.

On June 28, 1925, I secured at Sanchiang two specimens, one containing 11, the other 12 eggs apparently ready to be deposited, while about July 8 another example with 12 eggs in the same state was brought in (Pope, 1929, l.c.). A Yunnan female in the American Museum holds 13 well-developed eggs, one of which contains an early embryo about 15 mm. long. An average egg measures 36 x 24 mm., while the total length of the female is 1198 mm.

*Material examined*.—I have seen, among numerous specimens from China and adjacent countries, the type of *Coluber vaillanti*, in the Paris Museum.

*Remarks*.—Ever since Boulenger (1887, p. 170) synonymized Fischer's *grabowskyi* with *tæniurus*, the relationship of these two forms has been more or less problematical. Stejneger (1907, p. 319) apparently considered them distinct

species, while, more recently, Smith (1930, p. 49) has given *grabowskyi* sub-specific rank. I am thoroughly convinced that two distinct species, differing in no fewer than eight characters, are involved. Unfortunately, lack of good series of *grabowskyi* prevents my tabulating many data on that form, but the following enumeration and discussion of the eight distinguishing characters will, I believe, prove helpful to anyone interested.

1. The hemipenes of the two snakes differ in five details as follows:
  - a. The organ is longer in *grabowskyi*, extending to the fifteenth subcaudal plate.
  - b. The calyces cover a slightly more extensive area than the spines in *grabowskyi*.
  - c. The spines of *grabowskyi* are not as thick (individually) and much more compressed than those of *tæniurus*.
  - d. In *grabowskyi*, the large spines are preceded by a few small and medium-sized ones.
  - e. The calyces of *grabowskyi* are only shallowly scalloped.  
(Specimen of *grabowskyi* from Hinlap, 20 miles southwest of Korat, Siam, used for comparison.)
2. *E. grabowskyi* has a distinctly higher ventral count. The range of 276-305 reported for it by Smith (1930, p. 49) is based on nineteen specimens, including the cotypes (278 and 282), and may be compared to the counts of *tæniurus* given above.
3. Among forty specimens of *tæniurus* from Anhwei, Fukien, Yunnan and Szechwan, the preocular is not in contact with the frontal in thirty-two, barely so on both sides in four and on one side in three, and distinctly so on both sides in only one. In contrast to this, the preocular of *grabowskyi* is normally in contact with the frontal.
4. The internasals are relatively more elongate in *grabowskyi* than in *tæniurus*.
5. The frontal of *grabowskyi* is generally more elongate as well as narrower and more pointed posteriorly than that of *tæniurus*.
6. In *grabowskyi*, the loreal is a much more elongate scale than in *tæniurus*.
7. The body of *tæniurus* is less compressed than that of *grabowskyi*.
8. The color patterns of the two species are quite distinct in certain details as follows:
  - a. *E. grabowskyi* has a middorsal light stripe anteriorly, while in *tæniurus* this stripe fast loses its continuity as it approaches the head.
  - b. *E. tæniurus* is boldly blotched or barred anteriorly, while such markings are absent or only very faintly evident in *grabowskyi*.
  - c. In *tæniurus*, the (posterior) middorsal white stripe is slightly wider than that of the other species, but the low, lateral white stripe is somewhat wider in *grabowskyi* than in *tæniurus*.

In addition to possessing a slightly different color pattern, *grabowskyi*, then, is obviously a more elongate snake in both head and body than *tæniurus*. It would be extremely interesting to know whether this attenuation is correlated with more highly developed arboreal habits.

#### Genus *Rhynchophis* Mocquard

*Rhynchophis* Mocquard, 1897, Bull. Mus. Hist. Nat., Paris, III, p. 214 (type, *R. boulengeri*).

*Proboscoidophis* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 114 (type, *P. versicolor*).



The relationships of this monotypic genus are not clear. It is the only snake that I know of having a single rostral appendage covered with many small scales.

I believe the maxillary teeth are most correctly described as 19 to 22 in number, ungrooved, in a continuous series, about equal in length, the last one or two stouter than, and not as much recurved as, the rest.

#### OBVIOUS RECOGNITION CHARACTERS

Snout produced into a distinct pointed appendage covered with small scales; color uniform green above and below with very inconspicuous black and white margins discernible on some scales.

#### 73. *Rhynchophis boulengeri* Mocquard

Figure 59

*Rhynchophis Boulengeri* Mocquard, 1897, Bull. Mus. Hist. Nat., Paris, III, p. 215 (type locality, Norway Islands, Tongking).

*Probosciodophis versicolor* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 114, fig. 10 (type locality, Kuchen, Kwangsi; paratype from Lohsiang, Kwangsi).

*Description*.—A translation of the original description, apparently based on the six cotypes, follows:

Snout terminating in a conical appendage directed forward and upward, equal in length to the distance from its base to the anterior border of the eye or a little shorter, covered with small scales, and which has its origin between the rostral, the internasals and the anterior nasal of each side. Head elongated, triangular, swollen posteriorly and quite distinct from the neck. Eye moderate, with round pupil, its diameter contained twice in its distance from the nostril; the latter opens between two nasals; internasals about twice as short as the prefrontals; frontal very broad in front, with concave lateral margins, a little longer than its distance to the base of the rostral appendage, shorter than the parietals; frenal low, two or three times as long as high, sometimes divided by a vertical suture; one large preocular, in contact with the frontal; 2 postoculars; temporals 2 + 2 + 3 or 2 + 3 + 3 or 4; 9 upper labials, the 4th, 5th and 6th in contact with the eye; 10 or 11 lower labials, the first 4 or 5 in contact with the anterior submaxillaries, which are a little shorter than the posterior; 19 rows of smooth scales, provided with a pair of apical pits; gastrosteges, 207 to 214; anal divided; urosteges double, from 123 to 132. Maxillary teeth 19 in number, in a continuous series, the last two larger than the rest and not grooved; 25 mandibular teeth, the posterior ones diminishing in length.

The back is of a rather intense blue, uniform, changing to a paler bluish green on the sides, still paler on the ventral surface. Some scales on the trunk are bordered on one side with a touch of black. Six specimens, the largest of which is a female measuring 1 m. 134 mm. in total length, of which the tail is 300 mm.

Fan's *Probosciodophis versicolor*, in spite of certain recorded differences such as enlarged mid-maxillary and grooved posterior maxillary teeth, vertical pupil, and slightly higher ventral count (221), shows remarkable similarity to *R. boulengeri*, and is, without doubt, the same species. The difficulty of deter-

mining the exact nature of the teeth and whether they are grooved is well known, while the question of round as against vertical pupils is at best an unreliable character.

In Paris, I carefully compared Fan's description and figures of *P. versicolor* to four of the six known specimens of *R. boulengeri* and to Mocquard's description, finding the latter very accurate.

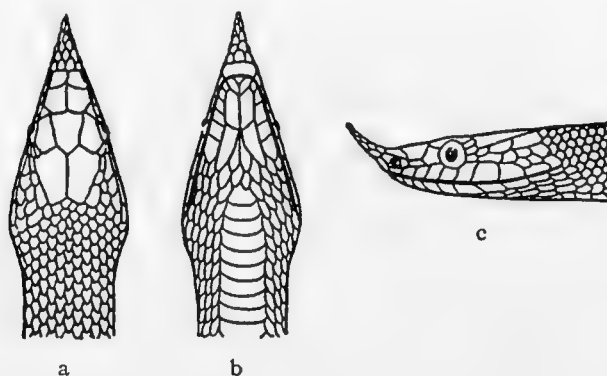


FIG. 59. *Rhynchophis boulengeri*. Nat. size. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. Specimen from Kuchen, Kwangsi. (From Fan.)

A few points are worthy of special notice, as follows:

1. The number of maxillary teeth is not easily ascertained for I got various results when making counts in Paris. The highest count made was 22. Mocquard gives 19, Fan 16.
2. The pupil is round in the four examples of *boulengeri* examined.
3. In counting the scale rows on the neck, at midbody, and near the vent, I got the following results for *boulengeri*: 21-19-15 in one and 19-19-15 in three.
4. Fan describes the scales of *versicolor* as "black margined or punctuated with white." In *boulengeri*, the scales are more or less black- or white-margined proximally. This black and white is, however, apparent only on close scrutiny, being largely hidden by the tips of the preceding scales. To all general appearances, the snake is uniform green above and below, but a little lighter below.
5. Fan's "longitudinal whitish line on either side along the lateral keeling of the ventral scales" is scarcely to be included as part of the color pattern but rather as the usual accompaniment of a well-developed lateral keel.
6. The color of Fan's paratype, a young male 335 + 109 mm. in length, is "beautiful old gold above, yellowish below, labials all white." This, apparently, represents the juvenile pattern.
7. All four specimens seen by me in Paris are females.
8. The type of *P. versicolor*, a female, has 221 ventrals and 127 subcaudals, while the paratype of the opposite sex has the same ventral count but only 116 subcaudals. The female, then, has the higher subcaudal count. The type measures 752 + 270 mm. in length.

*Distribution*.—This remarkable snake is known only from the type locality in Tongking; and Kuchen and Lohsiang in Kwangsi.

*Habits and Habitat*.—The Kwangsi specimens were apparently taken in wooded mountains, while the Norway Islands cotypes were found on bare rocks ("rochers arides").

It would be extremely interesting to learn about the feeding habits of this species and whether it is arboreal to any degree.

*Material examined*.—I have seen, in the Paris Museum, 4 of Mocquard's cotypes from the Norway Islands.

#### Genus *Dendrophis* Fitzinger

*Ahatulla* Gray, 1825, Ann. Phil., (N.S.) X, p. 208 (not of Link, 1807).

*Dendrophis* Fitzinger, 1826, Neue Class. Rept., pp. 29 and 30 (substitute name for *Ahatulla* Gray, 1825, type designated by Fitzinger, 1843, *Dendrophis picta* Boie).—Stejneger, 1933, Copeia, (N.S.) No. 4, p. 201 (discussion), p. 202 (synonymy).

This genus, as recently reviewed by Meise and Hennig (1932, pp. 273-297), includes *Dendrelaphis* Boulenger and consists of eight species widely distributed from Sind, in northwestern India, southeastward to the Pelew Islands, Santa Cruz (east of the Solomon Islands) and northern Australia.

*Dendrelaphis subocularis* Boulenger (*Dendrophis tristis subocularis* of Meise and Hennig), described from Bhamo in 1888 (p. 600), has since been secured in Siam and Indo-China as well as again in the region of the type locality (Huton). Its range closely approaches the borders of China.

Dr. Angel has very kindly investigated Duméril and Bibron's (1854, p. 202) Chinese record of *Dendrophis octolineata* (now a synonym of *D. caudolineatus*) and concluded that this record must be an error, since no material from China of the species in question, or record of such, can be found in the Paris Museum.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SUBSPECIES

A conspicuous black postocular stripe widening on the neck; snout wedge-shaped; scales smooth, oblique, middorsal row enlarged; ventrals with lateral keel and notch; habitus attenuate.

#### 74. *Dendrophis boiga boiga* (Lacépède)

Compare Figure 64, b

*Coluber boiga* Lacépède, 1789, Hist. Nat. Serp., II, p. 102 (type locality, Borneo, see p. 279).

*Coluber pictus* Gmelin, 1789, Syst. Nat., I, p. 1116 (no type locality indicated).

*Dendrophis Pictus* Boie, 1827, Isis, p. 530 (Java).—Wall, 1903, Proc. Zool. Soc. London, p. 92 (Hongkong) (*pictus*).

*Ahatulla boiga* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 445 (Nodoa, Hainan); p. 538 (Lungling, Yunnan).

*Dendrophis boiga* Stejneger, 1933, Copeia, (N.S.) No. 4, pp. 200-201 (discussion), p. 202 (synonymy).

*Description*.—Upper labials 9 or 10; preoculars single; postoculars 2; anterior temporals 1 or 2; posterior temporals 2; scales 15-13-11, smooth, oblique, vertebral row enlarged; ventrals in male 192, female 191; subcaudals in female

155; total length of female 944 mm. Color bluish green above and below, the scales more or less margined with black and a black stripe on side of head and neck. (Description based on a male from Lungling and a female from Nodoa.)

Cope (1895, Pl. XIX, fig. 8) has figured the hemipenis of "*picta*" from India. His illustration is reproduced here as Figure 64, b.

*Distribution*.—In China, this form has been recorded only from Hainan and western Yunnan (Lungling). It is also known from Hongkong.

Distributed from the Eastern Himalayas and Assam southward through the peninsula of southeastern Asia, the Malay Archipelago including the Philippines, and, according to Meise and Hennig (1932, p. 289), it also occurs in western Peninsular India from Bombay to Travancore.

*Habits and Habitat*.—Wall (1925, p. 813) says that this "is a fairly common snake in Burma, occurring throughout the plains and up to an elevation of about 4500 feet," but it probably ranges to higher altitudes in Yunnan for Lungling is 5200 feet above sea-level.

*D. boiga* is terrestrial as well as arboreal and is timid by nature. It subsists on lizards and frogs, which it apparently procures by day, being diurnal in habits. It is said to make long leaps from tree to tree. These notes on the habits of *boiga* have been abstracted from Wall, 1910, pp. 787-792, and 1921, p. 155; Mertens, 1930, p. 303; and Taylor, 1922, p. 168. Smith (1914, p. 96) states that this snake feeds only on frogs about Bangkok, and Hediger (1932, p. 239) has recently reviewed the "flying" or leaping habits of *boiga* and other species.

Kopstein (1930, p. 302, fig. 4, and 1932, p. 81, fig. 5) records this species on Java laying 5 eggs on March 12 and 5 eggs on May 14. The eggs of the first lot measured 32 x 9 mm., while the newly-born young of this same lot were 260-275 mm. long. Both lots hatched in 85 to 86 days. He also reports 8 eggs found on January 10 in a bamboo frame ("*Bambusstuhl*"). They hatched three to five days later. It would be extremely interesting to have comparative data on the breeding of *boiga* in China at the northern extremity of its range. When such comparative data on many widely distributed species are available, significant general conclusions on the effect of climate on breeding cycles may be drawn. It is for this reason that data from such distant regions are recorded here.

*Material examined*.—I have seen the only known Chinese specimens of this species: one from Nodoa, and the other from Lungling, both in the American Museum. Guenther (1858, p. 148) records 2 examples from China, but they are no longer in the British Museum and were not even recorded by Boulenger in 1894 (p. 79).

*Remarks*.—The great confusion that long existed over the correct generic

and specific names of *Dendrophis boiga* has, I believe, been finally clarified by Stejneger (1933, p. 199).

#### Genus *Eurypholis* Hallowell

*Eurypholis* Hallowell, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 493 (type, *E. semicarinatus*).

*Cyclophiops* Boulenger, 1888, Ann. Mus. Civ. Stor. Nat. Genova, (2) VI, p. 599 (type, *C. doriae*).

*Entechinus* Cope, 1895, Proc. Acad. Nat. Sci. Phila., XLVI, p. 427 (type, *Cyclophis major*).

*Entacanthus* Cope, 1900, Ann. Rep. U. S. Nat. Mus., 1898, p. 780 (type, *Cyclophis major*).

A careful study of considerable material has convinced me that the three species treated below, together with *Ablabes herminæ* Boettger, *Eurypholis semicarinatus* Hallowell (both of the Riu Kiu Islands), *Ablabes hamptoni* Boulenger, of Burma, and *Coluber vernalis* Harlan, of North America, are congeneric and, moreover, I have found no other species closely enough allied to any of these seven to be included in the same genus with them. Granting that I am correct in this matter of relationship, *Eurypholis* is the generic term that must be applied to the species in question, the two chief points involved being:

(a) The name *Ablabes*, most often used to designate them (Boulenger applied it to three of the seven in his Catalogue, while three others were called *Ablabes* by their describers), has been shown by Stejneger (1922, No. 2, p. 2) to be an unconditional synonym of *Gongylosoma* Fitzinger, the type of which, *Coronella baliodeira* Boie, obviously is not congeneric with the snakes of the group in question.

(b) *Liopeltis*, more recently used instead of *Ablabes*, is not applicable either because its type, *Herpetodryas tricolor* Schlegel, is no more closely allied to the seven forms under discussion than is *baliodeira*.

From a zoögeographic point of view, it is well to eliminate the Malayan *baliodeira* and *tricolor* from close relationship with the Chinese and American forms, while frequent alliance of species from China to others from the eastern United States is well known.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Color uniform green above with or without narrow bichromatic cross-bands posteriorly; scales in 15 rows throughout.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Anal entire; dorsum uniform green. . . . . *doriae*, p. 281
- II. Anal divided
  - A. Dorsum uniform light green. . . . . *major*, p. 283
  - B. Dorsum olive-green crossed by numerous narrow, bichromatic bands posteriorly. . . . . *multicinctus*, p. 285

#### 75. *Eurypholis doriae* (Boulenger)

Plate XI, A, B and C

*Cyclophiops doriae* Boulenger, 1888, Ann. Mus. Civ. Stor. Nat. Genova, (2) VI, p. 599, Pl. VI (type locality, Kachin Hills, Burma).

*Ablabes doriae* Boulenger, 1890, Fauna Brit. India, p. 306.

*Liopeltis doriae* Wall, 1924, Journ. Bombay Nat. Hist. Soc., XXIX, p. 864; 1925, XXX, p. 816 (Huton, Burma).

*Description*.—Upper labials 7, 4th and 5th entering orbit; preoculars single; postoculars 2; anterior temporals 1 or 2; posterior temporals 2; scales smooth, in 15 rows throughout; ventrals 168; snout to vent 800 mm. (Description based on the male from Hokow.)

Wall's (1925, p. 816) Huton specimen has 184 ventrals, 74 subcaudals and 29 or 30 maxillary teeth.

The original description, based on two specimens, follows:

Snout once and a half as long as the diameter of the eye, convex, profile curved from the frontal region to the lip; rostral as deep as broad; internasals a little shorter than, and half as broad as, the praefrontals; frontal nearly twice as broad as the supraoculars, longer than its distance from the end of the snout; parietals as long as praefrontals and frontal together; loreal small, a little longer than deep; a large praecocular, usually with a second, very small, below; two or three postoculars; temporals  $1 + 2$  or  $2 + 2$ ; eight upper labials, fourth and fifth entering the eye; four lower labials in contact with the anterior chin-shields; posterior chin-shields about half as large as the anterior. Scales in 15 rows; ventrals 187 or 173; anal undivided; subcaudals 80 or 77. Uniform green above, white inferiorly, the green colour extending on to the ends of the ventrals. Total length 91 centim.; tail 21.

The hemipenis is spinous proximally, calyculate distally. The two large basal hooks or spines are followed by about eighteen smaller, relatively uniform spines that end abruptly where the calyces begin. The calyces are at first large, with finely but not deeply scalloped edges, but gradually decrease in size and increase in number until they become extremely small and numerous. Moreover, their general appearance changes somewhat, due to a decrease in relative size and prominence of their longitudinal walls. The whole organ widens out distally into a large pocket. The undivided sulcus is relatively inconspicuous. (Description based on the specimen from Hokow.)

*Distribution*.—In China, *E. doriae* is known only from Hokow on the southeastern border of Yunnan. Elsewhere it has been collected in Assam (Manipur) and Upper Burma (Kachin Hills).

Wall (1903, p. 93) identified a snake in the Siccawei collection as *doriae*, and apparently takes this as evidence of its occurrence in the Yangtze Valley (1924, p. 864), but, judging by his description of the Siccawei specimen, it is small and in bad condition and therefore might easily have been misidentified. I am sure that *doriae* does not occur in the lower Yangtze Valley.

*Habits and Habitat*.—According to Wall (1925, p. 816), *doriae* is "a rare snake confined to hills above about 4000 feet." The Hokow record indicates that, at least in southeastern Yunnan, it descends to an altitude of only a few hundred feet.

*Material examined*.—I have seen only one specimen of this rare species: Museum of Comparative Zoölogy No. 17586 from Hokow, southeastern Yunnan.

76. *Eurypholis major* (Guenther)

Figures 60, and 64, c

*Cyclophis major* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 120 (type locality, near Ningpo).*Herpetodryas chloris* Hallowell, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 503 (type locality, Hongkong).*Ablabes major* Boettger, 1894, Ber. Senck. Ges., p. 140 (Lushan, Kiangsi).*Liopeltis major* Stejneger, 1907, Herp. Japan, p. 338, figs. 287-289.*Ablabes maior* Werner, 1909, Jahrb. Hamburg. Wiss. Anst., XXVI, Beih. 2, p. 225 (Fukien and Foochow).*Coluber delacouri* Smith, 1930, Ann. Mag. Nat. Hist., (10) VI, p. 681 (type locality, Fansipan Mountains, Tongking).

*Description*.—Upper labials 8, very rarely 7; preoculars single; postoculars 2; anterior temporals single; posterior temporals 2, very rarely 3; scales in 15 rows throughout, smooth, or posteriorly a few middorsal rows more or less strongly keeled; ventrals in eleven males 158-166, in eight females 161-170; subcaudals in eleven males 82-90, in seven females 76-82. Color uniform green above, lighter green or yellowish below. (Description based on nineteen specimens from Fukien.)

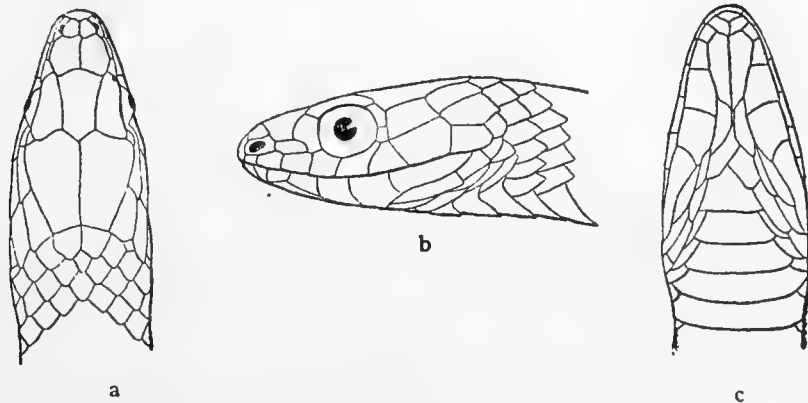


FIG. 60. *Eurypholis major*.  $\times 2$ . a. Dorsal view of head. b. Lateral view of head. c. Ventral view of head. U.S.N.M. No. 7335 from Hongkong. (From Stejneger.)

The three largest males among eighty-three specimens from Fukien measure 713, 710 and 650 mm. from snout to vent, while the corresponding figures for the three largest females from the same series are 678, 608 and 608. These data indicate that the males attain the greater body length, a point worthy of special note. (Pope, 1929, pp. 362 and 448.)

Three juveniles from Fukien (Yenping and Chungan Hsien), measuring 213, 231 and 235 mm. in total length, probably represent the approximate size of *major* when newly hatched.

A Kuatun specimen in the British Museum only 240 mm. from tip to tip has a series of black blotches along the middle of the back anteriorly. They are broader than long, irregular in shape, and rapidly decrease in size and distinctness as they approach the middle of the body. There are also traces of an

interrupted black lateral stripe. Boulenger (1899, p. 165) long ago remarked on this unusual specimen which apparently exhibits a juvenile pattern of rare occurrence in *major* but frequently seen in allied species.

Cope has already described (1895, p. 427) and figured (1895, Pl. XVIII, fig. 6) the characteristic hemipenis of *major*. His illustration is reproduced here as Figure 64, c. He was convinced that the small spines within the calyces warranted the erection of a monotypic genus for *major* and, in fact, proposed the name *Entechinus* in 1895 (p. 427) and *Entacanthus* in 1900 (p. 780). In this connection it is interesting to note that the hemipenis of *E. doriae* lacks these small, intercalyculate spines (see under *doriae*).

*Distribution*.—This species is distributed over much of southeastern China, even reaching Tongking. Its range, exclusive of Szechwan and Formosa, is delimited by the following localities where it has been secured:

East: Shanghai to Hongkong.

South: Lofaoshan in Kwangtung; Lohsiang in Kwangsi; and the Fansipan Mountains of Tongking.

West: Yunshan, near Wukang, Hunan.

North: Eight days N.W. of Ichang in Hupeh; Lushan of Kiangsi; Mokanshan in Chekiang; and the region of Soochow.

*E. major* extends its range westward from Hupeh into Szechwan. In the latter province, it has been collected in the region of Hochuan; on Mt. Omei; in Opien Hsien; at Süchow; at Chouchiakou, south of Süchow; and on the Yunnan border, south of Süchow. The presence of *major* at Shanghai and Soochow is of special interest because it is not included in the Nanking fauna by Chang and Fang (1931, p. 249). Moreover, I failed to secure it at Ningkwo, Anhwei. It is common on Formosa (Maki, 1931, p. 108).

*Habits and Habitat*.—I found this snake extremely abundant in the Yenping mountains but much less so in those about Sanchiang and Kuatun and in Futsing Hsien. It was also secured on the Chungan plateau near Chungan City (Pope, 1929, p. 448). Mell (1922, p. 121) states that it is the commonest snake in the mountain forests of northern Kwangtung but relatively rare in the southern part of that province. It is "common near Kiu-kiang" (Guenther, 1892, p. 241), and "not uncommon" on Hongkong (Wall, 1903, p. 93). Judging by the series collected at Lohsiang, it is abundant there, too (Fan, 1931, p. 91).

*E. major* is primarily an inhabitant of mountains, but, at least in the northern part of its range, may descend to very low levels, as is proved by the Shanghai and other records. It is frequently found at high altitudes, especially in Szechwan. Chang (1932, p. 68) records it from 1700 and 1300 meters on Mt. Omei and in Opien Hsien, respectively, while there are two speci-



mens in the U. S. National Museum (Nos. 78773 and 79894) collected at 6000 feet on the Yunnan-Szechwan border, south of Sūchow.

Near Yenping I daily met this snake gliding about on the forest floor. It is apparently diurnal. It neither bites, strikes, nor assumes a defensive pose when annoyed (Pope, 1929, l.c.).

The stomachs of nine Fukien examples contained earthworms, while five others held gritty earth, facts indicating a uniform diet of earthworms (Pope, 1929, l.c.). Maki (1931, p. 109) states that Formosan *major* feeds "on caterpillars and earthworms."

On July 24, a gravid female containing 8 well-developed, pure white eggs was brought in at Kuatun. Two eggs measured 29 x 14 and 30 x 13.5 mm. The following day a second female holding 13 eggs was brought. It was a longer specimen (total length 1055 as compared with 935 mm.) and the eggs somewhat thicker, one measuring 17 mm. in its shorter diameter. Six preserved Chungan Hsien females were gravid, three containing 7, one 6, one 4 and one 8 eggs (Pope, 1929, l.c.). The two with 4 and 8 eggs were collected between June 12 and July 20. A gravid Formosan specimen in the Museum of Comparative Zoölogy holds 6 well-developed eggs with embryos still in the earliest stages of development. *E. major* is certainly oviparous.

*Material examined*.—I have examined the types of *major* and *Coluber delacouri* in the British Museum. In addition to these specimens of special importance, I have seen the following interesting Chinese material not yet recorded in literature: 4 examples from Tunglu, in the Museum of Comparative Zoölogy; 2 from Chouchiakou, and 2 from the Yunnan-Szechwan border south of Sūchow, in the U. S. National Museum.

*Remarks*.—Fan (1931, p. 93) has remarked on the frequent presence of keels on some middorsal rows in specimens from Lohsiang (31 among 50 had keels developed to some degree). I find that keels may be detected in 19 out of 45 Fukien *major*, but in no case are they either as numerous or well developed as in a Lohsiang example examined by me in the Museum of Comparative Zoölogy. This individual has 7 scale rows keeled just before the vent, 5 at mid-body, and 1 three head-lengths posterior to the head. The keels of the innermost carinated rows are quite distinct. Maki's (1931, p. 110) *Liopeltis major bicarinata* is apparently based on Formosan specimens of *major* with a few keeled rows.

#### 77. *Eurypholis multicinctus* (Roux)

*Ablabes multicinctus* Roux, 1907, Zool. Anz., XXXI, p. 762 (type locality, Tongking).

*Ablabes retrofasciatus* Angel, 1920, Bull. Mus. Hist. Nat., Paris, XXVI, p. 293, fig. 4 (type locality, Laos).

*Zamenis moi* Smith, 1921, Proc. Zool. Soc. London, p. 425 (type locality, Dran, Annam, 1000 meters).—Parker, 1925, Ann. Mag. Nat. Hist., (9) XV, p. 303 (Thai-Nien, Tongking).

*Liopeltis sinii* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 93, figs. 7 and 8 (type locality, Lohsiang, Kwangsi).

*Liopeltis multicinctus* Angel and Bourret, 1933, Bull. Soc. Zool. France, LVIII, p. 135 (Chapa, Tongking, about 1500 meters).

*Description*.—Upper labials 7 or 8, 4th and 5th entering orbit; preoculars single; postoculars 2, occasionally 1; anterior temporals single; posterior temporals 2; scales smooth, in 15 rows throughout; ventrals in three males 168-169, female 172; subcaudals in three males 96-103, female 72; largest male 754+315, female 638+265 mm. (Description based on the type of *retro-fasciatus*, that of *moi*, and the type and paratype of *sinii*.)

The female subcaudal count of 72 given above is probably an error (compare Fan, 1931, pp. 91 and 95).

A Thai-Nien example is apparently slightly abnormal with upper labials 5-6, lower labials 6-7. Its ventrals and subcaudals are 170 and 96, respectively. (Parker, 1925, p. 303.) A Chapa specimen has 170 ventrals and 103 subcaudals (Angel and Bourret, 1933, p. 135).

Smith (1921, p. 425) gives the maxillary count as 18, Fan (1931, p. 93) as 16.

A translation of the original description, based on the type specimen, follows:

Head narrow, only indistinctly set off from the body. Snout moderately long. Dorsal profile convex, curved from the frontal region to the rostrum. Rostral broader than high, only very little visible from above. Eye large, amounting to somewhat more than half the length of the snout. Nasal divided in half. Internasal suture somewhat smaller than that between the prefrontals. The latter very large, arched somewhat on the side. Frontal hexagonal, broader anteriorly than posteriorly; the anterior breadth amounts to  $\frac{2}{3}$  of the length. The frontal as long as its distance from the tip of the snout and about  $\frac{2}{3}$  as long as the parietals. Loreal region vertical; loreal twice as long as high. Preocular large. Two postoculars, of which the upper is twice as high as the lower and alone is in contact with the parietals. Temporals 1 + 2. Upper labials seven in number. The first very small, the sixth the largest. The fourth and fifth under the eye. Four lower labials in contact with the anterior pair of chin-shields. The latter somewhat shorter than the posterior which are in contact only in front. Fifteen rows of smooth scales on the dorsum. Ventral plates 168 in number. Anal divided. Ninety-eight subcaudal shields disposed in pairs.

Coloration (in alcohol): Dorsal surface and sides dark blue-gray. On the anterior, laterally somewhat compressed half of the body, this color is uniform. Farther back, where the body becomes thicker and more cylindrical, the back bears numerous, narrow cross-stripes. These consist of one or two series, in which the scales are darker colored and edged with whitish. Their mutual distance is formed by two or three scale rows. There are 38 such stripes on the back. These spots become pale in the caudal region, but are still more or less visible. Head uniform blue-gray. Underside of the latter and the anterior half of the belly whitish. Lower lips somewhat gray-spotted. Farther back the ventral surface is sprinkled with gray, and then colored uniform bluish gray. Subcaudals gray and whitish. The sides of the ventral plates colored similarly to the back. Measurements: Total length 1060 mm.; length of tail 250 mm.

The hemipenis is spinous proximally, calyculate distally. There is a very large basal spine or hook followed by two or three successively smaller ones. Close to and more or less surrounding these are a few relatively uniform spines that end abruptly where the calyces begin. The calyces are everywhere numerous and with finely but shallowly scalloped edges. They gradually decrease in size and increase in number toward the tip of the organ where they are extremely fine and numerous. Moreover, their general appearance changes, due to a decrease in relative size and prominence of their longitudinal walls. One or two conspicuous longitudinal ridges are evident in the calyculate area, but the sulcus is not raised on a ridge. (Description based on the type of *retrofasciatus*.)

*Distribution*.—In China, this snake is known only from Lohsiang. Its range extends from southern Annam (Dran) northward through Laos and Tongking (Thai-Nien and Chapa) into Kwangsi.

*Habits and Habitat*.—Fan (1931, p. 95) states that in "habits and breeding conditions" this species is similar to *E. major*, but gives no data. Smith (1921, p. 426) records it from Dran, a locality in forested "hills" (p. 424) at 1000 meters altitude. Most of the records suggest a mountain habitat, but its presence at Thai-Nien (Parker, 1925, l.c.) indicates that it descends to approximately 300 feet in Tongking.

*Material examined*.—I have seen the type of *moi*, and the Thai-Nien example, in the British Museum; and the type of *retrofasciatus*, in the Paris Museum.

*Remarks*.—At first sight, it might seem remarkable that a species as characteristic as *multicinctus* should receive so many names. A comparison of these names, however, shows that the difficulty presented by *multicinctus* is generic rather than specific, belonging, as it does, to a large group of forms different members of which have been variously assigned to *Elaphe*, *Coluber*, *Ablabes*, *Zamenis* and *Liopeltis*. The relationships of these genera are not understood and cannot be elucidated until a thorough study of the huge aggregate of species assigned to them from widely separated regions has been made. There can be no doubt that but a single form is involved in the present case.

The snout of Angel's *retrofasciatus* type is badly mashed and flattened, so that both his description and figure, but especially the latter, are misleading. I cannot determine the exact status of *Ablabes multicinctus* var. *bicolor* Angel, 1929 (p. 79), described from Laos because the original description is so brief.

#### Genus *Coronella* Laurenti

The presence of this genus in China is of special interest because elsewhere

it occurs only in Peninsular India (*brachyura*), extreme western Asia (*austriaca*), Europe (*austriaca* and *gironica*) and Africa (several species).

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Middorsum with 52 black-edged, clear gray cross-bars; 229 ventrals, 51 subcaudals; scales smooth, in 19 rows.

#### 78. *Coronella bella* Stanley

*Coronella* sp. n.? Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 27 (Fukien).

*Coronella bella* Stanley, 1916, XLVII, p. 84, figs. (type locality, Kuatun, Fukien).

*Description*.—The original description, based on the only known specimen, follows:

Maxillary teeth 9, approximately equal; mandibular teeth 11, very small and approximately equal. Head short, scarcely distinct from neck; snout rounded; eye rather small, with round pupil. Body cylindrical; tail moderate. Rostral broader than deep, visible from above; suture between internasals shorter than that between the prefrontals; frontal as long as its distance from the end of snout, a little shorter than the parietals. Small almost square loreal on right side only. One preocular, two postoculars. Temporals 1 and 2. Seven upper labials, third and fourth entering eye. Nine lower labials, the first five in contact with chin shields. Anterior chin shield half as long again as posterior. Scales in 19 almost parallel rows, smooth, no apical pits. Ventrals 229, anal divided; sub-caudals 51 in two rows.

Colour, above, clear light gray; yellowish white below, with indistinct speckled gray blotch round centre of each ventral with black rectangular marking at outer edges occurring at intervals of 2 or 3 scales and not symmetrically placed on either side; tail free from markings. The dorsal surface has 52 crossbars consisting of a clear gray space with an irregular black margin about a scale in width, being lost on the flanks where it becomes replaced by irregular spots which towards the neck and tail become arranged in circular patterns. The space between the bars is gridironed by about 10 irregular black lines at the edge of the parallel scales. On the head the bar becomes Y-shaped with the two arms ending above the eye, the gridiron arrangement becoming a figure resembling a candlestick with base resting on the apex of the rostral. Length 95 cm.; tail 12.5 cm.

*Distribution*.—This elusive snake is known only from Kuatun where I failed to secure a second specimen.

*Habits and Habitat*.—*Coronella bella* is, in all probability, an inhabitant of mountain forests. If not exceedingly rare, it is very secretive, or, in fact, it may be both rare and secretive!

*Remarks*.—Werner's (1929, pp. 126 and 128) *Coronella pulchra* from China is obviously an error for *C. bella* which is omitted by him.

#### Genus *Holarchus* Cope

*Holarchus* Cope, 1887, Bull. U. S. Nat. Mus., No. 32, p. 54 (no species named).

*Dicraulax* Cope, 1893, Amer. Naturalist, XXVII, p. 480 (type, *Holarchus tri-notatus*).

Since no type of this genus has heretofore been named, I now designate *Simotes formosanus* Guenther as the type. This step is imperative because of

the array of species referred to *Holarchus* and *Oligodon*. *Simotes*, though of long usage, is preoccupied by a group of mammals and therefore has no standing (Stejneger, 1907, p. 353). Although this array of species has in some respects a remarkable similarity of appearance, a study of their hemipenes shows that several natural groups must be involved and only by designating a type for each group can a basis for further studies be established. Already the structure of the copulatory organs of no less than twelve species is known and the remarkable variety of form exhibited by these is demonstrated in Table XXXIX.

TABLE XXXIX. CORRELATION OF SCALE ROW COUNTS AND HEMIPENIAL STRUCTURE IN SPECIES OF *HOLARCHUS* AND *OLIGODON*

<i>Species</i>	<i>Spines Present or Absent</i>	<i>Hemipenis Forked or Not</i>	<i>Papillæ Present or Absent</i>	<i>Sulcus Divided or Not</i>	<i>Anal Entire or Divided</i>	<i>Scale Rows</i>	<i>Source</i>
<i>O. planiceps</i> . . . . .	present	not forked	2 present	not divided	divided	13-13-13	American Museum No. 27454
<i>O. tæniolatus</i> . . . . .	present	not forked			divided	15-15-15	Wall, 1923, pp. 306 and 332
<i>O. sublineatus</i> . . . . .	present	not forked			divided	15-15-15	Wall, 1923, pp. 306 and 333, fig. B
<i>O. ornatus musyi</i> . . . . .	present	not forked	absent	not divided	divided	15-15-15	present work
<i>O. theobaldi</i> . . . . .	present	not forked	2 present	not divided	divided	17-17-15	American Museum No. 43390
<i>O. bitorquatus</i> . . . . .	a few present	not forked	2 present	not divided	entire	?-17-?	Cope, 1895, Pl. xiv, fig. 5
<i>H. ancorus</i> . . . . .	absent	not forked	2 present	not divided	entire	?-17-?	Cope, 1895, Pl. xiv, fig. 4
<i>H. violaceus</i> . . . . .	absent	not forked	2 present	not divided	entire	17-17-15	present work
<i>H. juglandifer</i> . . . . .	absent	forked at tip			entire	19-19-15	Wall, 1923, pp. 306 and 334
<i>H. albocinctus</i> . . . . .	absent	forked at tip			entire	19-19-15 or 21-21-15	Wall, 1923, pp. 306 and 334, fig. A
<i>H. formosanus</i> . . . . .	absent	deeply forked	2 present		entire	19-19(17)-15	present work
<i>H. chinensis</i> . . . . .	absent	deeply forked	absent		entire	17-17-15	present work

A comparison of this simple table with the excellent one prepared by Wall in 1923 (pp. 332-334) shows that the types of hemipenes correlate well with variations in external structure and also that intergradation is present in penial as well as external characters. Nevertheless, by consideration of all characters, it should be possible to arrange the large number of species involved into distinct groups. At present, it is impossible to say just where generic division or divisions should come but one fact is of special interest, i.e., *Oligodon bitorquatus* Boie, the type of the genus, undoubtedly represents an intermediate stage between the two extremes involved.

Entirely aside from the immediate problem of arranging the species of *Oligodon* and *Holarchus* in a reasonable order, the hemipenes of these snakes prove how wide a variety of penial structure may be found in allied and externally very similar snakes. This same fact has been demonstrated recently for pit-vipers of the genus *Trimeresurus* (Pope and Pope, 1933, No. 620), and since Dunn (1928, p. 18), like Cope in former days, is using the hemipenis as a major factor in ophidian classification, it is readily seen what importance may be attached to its extreme variations in a lot of closely allied forms sometimes even united into a single genus (Wall, 1923, p. 305). Moreover, it may be possible to gain some insight into the way in which this organ has changed from one type into another, because probably every degree of gradation from one extreme to another exists among the *Oligodon-Holarchus* species, numbering, as they do, approximately sixty forms.

*Holarchus albocinctus*, although not known from China, has been collected in Burma near the Yunnan border (Wall, 1923, p. 326; 1925, p. 815, and 1926, p. 563).

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Rostral unusually well developed; scales smooth; anal entire.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Scales in 19 rows anteriorly . . . . . *formosanus*, p. 293
- II. Scales in 17, rarely 15, rows anteriorly
  - A. Ventrums with a double row of distinct black spots; a conspicuous design on head and neck . . . . . *chinensis*, p. 291
  - B. Ventrums without black spots; head and neck without design . . . *violaceus*, p. 297

I am aware that *violaceus* is described by various authors as having a variable pattern that would, in part, prevent its ready identification by the above key, but I am sure, on the other hand, that no trouble will be experienced with Chinese specimens. Moreover, I think it highly probable that at least one other form is confused with *violaceus*, a species exhibiting in China a remarkable lack of variation in coloration. Cantor's original description describes the ventrum as pearl-colored and mentions no conspicuous markings,

a fact strongly indicating that his type material was, like the Chinese specimens alluded to above and described in detail below, quite devoid of a striking pattern. Although his original description consists of only nine words, a comparison of it with others on the same page shows that he did not overlook prominent elements of coloration and must have devoted so few words to *violaceus* simply because it did not have a contrasted pattern. Wall (1923, p. 318) has summarized the alleged color varieties of *violaceus* as generally recognized today. This discussion really belongs under the treatment of the species in question but is placed here to avoid confusion in using the key.

79. *Holarchus chinensis* (Guenther)

Plate XI, F, G, H and I

*Simotes chinensis* Guenther, 1888, Ann. Mag. Nat. Hist., (6) I, p. 169 (type locality, Lushan, Kiangsi).—Boulenger, 1894, Cat. Snakes Brit. Mus., II, p. 228, Pl. IX.—Wall, 1903, Proc. Zool. Soc. London, p. 93 (Kiangyin, Kiangsu).

*Simotes longicauda* Boulenger, 1903, Ann. Mag. Nat. Hist., (7) XII, p. 351 (type locality, Manson Mts., Tongking, 3000-4000 feet).

*Holarchus chinensis* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 537 (Ningkwo, Anhwei; and Yunnanfu).—Chang and Fang, 1931, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VII, p. 261, fig. 6 (Nanking).

*Description*.—Upper labials 7 or 8, rarely 9; preoculars 1 or 2; postoculars 2; anterior temporals 1 or 2, very rarely 3; posterior temporals normally 2; scales smooth, in 17 rows on the neck and at midbody, 15 before the vent; ventrals in five males 170-183, in two females 190-192; subcaudals in five males 55-61, in two females 50-51; dorsal cross-bands 10-13 + 3-4; largest male 481 + 117, female 512 + 90 mm. (Description based on two specimens from Yenping, one from Chungan Hsien, two from Hokow, one from Ningkwo, and one from Yunnanfu.)

Fan (1931, p. 97) gives the ventrals and subcaudals of five males and one female from Lohsiang as 179-182 and 62-65, 193 and 53, respectively. One of his males measured 654 mm. in total length, 530 from snout to vent. Chang and Fang (1931, p. 263) report the ventral and subcaudal counts of five unsexed Nanking specimens as 179-189 and 49-62, respectively. Their specimens ranged in total length from 262 to 630 mm.

Sexual dimorphism in color has been suggested but not proved in *chinensis* (Pope, 1929, p. 450). Females are relatively rare in collections.

The original description, based on the type specimen, a juvenile female, follows:

Scales in seventeen rows. Eight upper labials, the fourth and fifth entering the orbit; loreal square; one præ- and two postoculars; anterior chin-shields in contact with four lower labials. Ventral shields 190, distinctly keeled on the sides; subcaudals 63, anal entire. The ground-colour is a light brownish grey; trunk crossed by thirteen, tail by four narrow, equidistant, black cross bars; these are somewhat broader on the back than on the sides, and

indistinctly edged with white. A black band from eye to eye and continued over the fifth and sixth labials. The black arrow-shaped spot on the neck is well defined. Abdomen with numerous square black spots, each occupying one half or the whole of a ventral scute. Subcaudals uniform white. One young specimen measures  $8\frac{1}{2}$  inches, the tail being 2 inches long.

The subcaudal count of the type almost certainly is 55 instead of 63 as given in the original description above (Boulenger, 1894, p. 228). Mr. H. W. Parker has kindly checked the sex of the type for me.

The very characteristic hemipenis extends to the fourteenth subcaudal plate and is forked opposite the fifth. It is entirely devoid of spines but replete with numerous, smooth, small cross folds that lie more or less obliquely and assume the form of calyces only near the tip of the hemipenis. These folds are interrupted by a very large diagonal ridge that arises a short distance beyond the point of forking and terminates near the tip of the organ. It is much reduced in size distally but has a conspicuous, free, proximal end. Numerous narrow, longitudinal folds extend distally from the large ridge but they do not interrupt the cross folds. (Description based on a specimen from Hokow.)

*Distribution*.—*H. chinensis* is known only from the following localities in China:

Kiangsu: Kiangyin; Nanking.

Anhwei: Ningkwo.

Kiangsi: Lushan; Hokow.

Chekiang: Lanchi.

Fukien: Chungan Hsien; Yenping.

Kwangtung: Chayuanshan and Lungtou.

Kwangsi: Lohsiang.

Yunnan: Yunnanfu.

This snake is also known from Tongking (Manson Mts.), as *longicauda*.

Boulenger's (1894, p. 228) Hoihow record is undoubtedly erroneous (Stejneger, 1907, p. 318).

*Habits and Habitat*.—Few field notes have been published on this species. The locality records indicate, however, that it occurs at low altitudes in central China but higher ones in southern China and Tongking. I failed to find it in the Kuatun-Sanchiang mountains, while Mell (1922, p. 121) records it as common in those of northern Kwangtung where its altitudinal range is 400-800 meters. Its presence at Yunnanfu is proof that it ascends to at least 6000 feet in eastern Yunnan.

*H. chinensis* frequents open plains and plateaus in central China. It is apparently a mountain snake in southern China.

Mell (1929, p. 242) has seen young *chinensis* attacked by *Sphenomorphus*



*indicus* and *Eumeces elegans* and he thinks that it may be an egg-eater fond of lizard eggs.

*Material examined*.—I have seen the following specimens: the type of *chinensis* and that of *longicauda*, 2 examples from "Hoihow," and 1 from Kiangyin, in the British Museum; 1 each from Yunnanfu, Ningkwo, and Chungan Hsien, and 2 each from Yenping and Hokow, in the American Museum; and 2 from Lanchi, in the U. S. National Museum.

*Remarks*.—An examination of the type of Boulenger's *longicauda* has convinced me that it is only *chinensis*.

Smith's *longicauda joynsoni* (1917, p. 276) represents, in my opinion, an entirely different species.

Boulenger (1894, p. 228) records material from Hainan collected by Neumann, but Stejneger (1907, p. 318) has already suggested that Neumann's "Hoihow" collection must have been secured elsewhere. This suggestion is so well warranted that it may now be considered an established fact.

#### 80. *Holarchus formosanus* (Guenther)

##### Plate XI, D and E

*Simotes formosanus* Guenther, 1872, Ann. Mag. Nat. Hist., (4) IX, p. 20 (type locality, Takao, Formosa).—

Boulenger, 1894, Cat. Snakes Brit. Mus., II, p. 222, Pl. VIII (Swatow, Kwangtung).

*Simotes bicalenatus* Müller, 1878, Verh. Naturf. Ges. Basel, VI, p. 595 (Fumun, Kwangtung) (not of Guenther, 1864).

*Simotes hainanensis* Boettger, 1894, Ber. Senck. Ges., p. 133, Pl. III (type locality, Hainan).

*Holarchus formosanus* Stejneger, 1907, Herp. Japan, p. 354, figs. 304-306 (Formosa).

*Holarchus nesiotis* Barbour, 1908, Bull. Mus. Comp. Zool., LI, p. 318 (type locality, Tingan, Hainan); 1909, Proc. New England Zool. Club, IV, p. 71, Pl. VII.

*Holarchus formosanus hainanensis* Barbour, 1909, Proc. New England Zool. Club, IV, p. 70 (Tingan and Wuchih Mts., Hainan).

*Simotes cyclurus* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 27 (Chinkiang, Kiangsu; Wenchow, Chekiang; Nanchang, Kiangsi; and Fukien) (not of Cantor, 1839).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 121 (Chiufeng and Wuyung, Kwangtung) (not of Cantor, 1839).

*Simotes vaillanti* Stanley, 1914, l.c. (Yungchun and Ningteh, Fukien) (not of Sauvage, 1877).

*Holarchus formosanus violaceoides* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 323 (type locality, Yaoshan, Kwangsi).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 100 (Lohsiang and Chinhsiu, Kwangsi).

*Holarchus formosanus brunnea* Mell, 1930, l.c. (type locality, Yaoshan, Kwangsi).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 97 (Lohsiang and Chinhsiu, Kwangsi).

*Description*.—Upper labials 8, very rarely 7; preoculars 2; postoculars 2, very rarely 1; anterior temporals 1, very rarely 2; posterior temporals 2, very rarely 1; scales smooth, in 19 rows on the neck, 19, rarely 17, at midbody, and 17 or 15 before the vent; ventrals in four males 159-162, in five females 164-168; subcaudals in four males 46-50, in four females 42-45; largest males 525 + 111 and 480 + 115, females 467 + 87 and 465 + 85 mm. (Description based on eight specimens from Fukien and one from Hokow.)

Table XL shows the ventral and subcaudal counts of series from localities as indicated, the figures in parentheses representing the number of specimens in each series.

TABLE XL. VENTRAL AND SUBCAUDAL COUNTS OF *HOLARCHUS FORMOSANUS* FROM CHINA AND FORMOSA

Locality	Ventrals		Subcaudals		Reference
	Males	Females	Males	Females	
Formosa.....	(6)161-163	(10)156-173	(6)46-55	(10)39-51	Maki, 1931, p. 132
Yaoshan.....	(10)159-166	(11)162-172	(10)48-55	(11)38-55	Fan, 1931, pp. 99 and 101
Hainan.....	(5)165-171	(3)175-178	(5)54-59	(3)50-51	Schmidt, 1927, p. 447

This table shows clearly that Hainan specimens have a slightly higher ventral and subcaudal count than those from Formosa and the mainland. This fact has long been recognized and Boettger's name *hainanensis* applied to the form from that island. I strongly suspect that material from the lowlands of Tongking and northern Annam will prove to have high counts also and, in that case, the name *hainanensis* may be applied to them as well. In fact, this view was suggested to me by a Tongking female in the British Museum with 176 ventrals.

The dimensions quoted above as well as those given by Schmidt (1927, l.c.), indicate that the male attains the greater length. Maki's (1931, p. 132) data, however, suggest the opposite conclusion, so this point requires further investigation.

The original description, based on the type specimen, a male, follows:

Scales in nineteen rows. Ventrals 164; anal entire; subcaudals 54. Two præoculars, the superior of which is the larger; two postoculars. Seven upper labials, the third and fourth entering the orbit. Posterior chin-shields only half the size of the anterior. Light brownish; many scales with a black edge, these black edges forming a great number of reticulated transverse lines extending across the back and sides. Lower parts uniform yellow; a rather indistinct whitish line along each edge of the abdomen. It is 22 inches long; tail  $4\frac{1}{2}$  inches.

The hemipenis is forked opposite the sixth to seventh subcaudal plates, while one branch extends to the fifteenth, the other to the seventeenth plate. There are no spines, but an extensive proximal area of cross folds or flounces that gradually merge distally into a much less extensive calyculate region, the calyces of which are shallow and smooth-edged. Beyond the point of forking, the sulcus is laterally asymmetrical, being bounded on one side by a raised lip which, in turn, is backed by a prominent ridge; on the other, by a low, wide

area of smooth-edged calyces. The ridge that backs the sulcus is flounced proximally, calyculate distally, and runs into a large papilla-shaped process at the tip of the organ. This process has a calyculate surface. (Description based on a specimen from Hainan.)

*Distribution*:—Due to the confusion of *formosanus* with other species, as explained below, the limits of its range are hard to define, but I am convinced that its occurrence at the following localities in China and Tongking is well established:

Chekiang: Wenchow.

Kiangsi: Hokow; Nanchang.

Fukien: Ningteh; Foochow; Futsing Hsien; Yenping; Chungan Hsien; Yungchun; Amoy.

Kwangtung: Swatow; Fumun; Wuyung; Lofaoshan; Chiufeng; Wanszushan; Macao.

Hainan: (several localities).

Kwangsi: Lohsiang and Chinsiu.

Tongking: Caobang.

Stanley's record for Chinkiang probably requires confirmation since *formosanus* is not reported from Nanking by Chang and Fang (1931, p. 249). I am unable to identify with certainty the Tungung whence Stanley (1917, p. xiii) recorded "*Simotes cyclurus*."

*Holarchus formosanus* is well known on Formosa where it was first secured.

*Habits and Habitat*:—I found *formosanus* to be generally distributed in northern Fukien save in the high, forested mountains about Kuatun and Sanchiang where it was apparently absent. In central China, at least, it seems to frequent low plains, plateaus and open hilly regions. Mell (1922, p. 121) reports it as relatively uncommon in southern Kwangtung but universally distributed in the northern part of that province. It is obviously not rare in Yaoshan (Fan, 1931, pp. 97 and 100), so it may be more of a mountain snake in the southern parts of its range. This matter is, however, greatly complicated by the possible existence of a southern form, *hainanensis*, with higher ventral and subcaudal counts that may exhibit habitat preferences differing from those of the typical form.

The stomach of a *Nodoa* specimen held the remains of about eight similar reptile eggs, a fact of special interest because several other species of *Holarchus* (and *Oligodon*) are egg-eaters (Wall, 1923, p. 306).

A *Nodoa* specimen seen by me raised the head slightly, compressed the neck vertically, and bent it into an S curve when annoyed. The tail was noticeably curled. I caught another *Nodoa* individual in the Mission Compound just after dark on July 25. Although large, it was extremely mild tempered, showing no inclination to bite.

*Material examined*.—I have seen specimens from China and Tongking as follows: 1 each from South China, Yungchun (received from Shanghai Museum), Amoy, southern Fukien, Swatow, Macao, Lohsiang, Tongking and Caobang (Tongking), in the British Museum; 1 from Kwangtung (No. 27681), in the Berlin Museum; the type of *nesiotis*, another specimen from Tingan, and 1 from Lohsiang, in the Museum of Comparative Zoölogy; 8 from Nodoa, 4 from Futsing Hsien, 1 from Foochow, 2 from Yenping and 1 each from Chungan Hsien and Hokow, in the American Museum; and 1 from Foochow, in the U. S. National Museum.

*Remarks*.—The history of the introduction of *Holarchus cyclurus* into, and its subsequent general inclusion as part of, the fauna of southeastern China is too involved to set down here in detail. However, examination of a large amount of Chinese material, and a careful study of Swinhoe's specimen collected in South China and listed by Boulenger (1894, p. 220) as *Simotes cyclurus*, convinces me that this species has no place in the fauna of southeastern China. Moreover, it is obvious that many examples of *Holarchus* cannot be identified with certainty by the use of scale characters alone, while a comparison of hemipenes renders their determination relatively simple. Surely, then, since no notice has been taken of penial characters, little reliance can be placed upon previous records of *cyclurus* from the Chinese region. The foregoing synonymy includes only the most important records of "*cyclurus*" from China.

The snake described by Duméril and Bibron (1854, p. 631) as *Simotes tri-notatus* has led to the inclusion of *purpurascens* in the Chinese fauna, for Boulenger (1894, p. 218) placed *tri-notatus* in his synonymy of *purpurascens*. Judging by the original description and the additional information kindly sent me by Dr. Angel (1 pre- and 1 subocular, 2 postoculars, temporals 2+2 and 2+3, scales in 22 rows on the neck, 21 at midbody and 17 before the vent, female sex), *tri-notatus* cannot be *formosanus*, but I am equally sure that it should not be considered a legitimate basis for the inclusion of either *cyclurus* or *purpurascens* in the fauna of China. Its identity and logical allocation must remain a mystery for the present at least.

Smith (1930, p. 53) follows Wall (1923, p. 328) in reducing *cyclurus* to a subspecies of *purpurascens*, but I am convinced that at least two quite distinct species are masquerading under these two names. However, this matter does not directly concern the problem at hand but is mentioned only in passing because, if one may judge by Wall's (1925, p. 815, and 1926, p. 563) more recent records for Burma, at least one of the species confused under these two names is sure to be found some day in western or southern Yunnan. If there were any evidence that the type of *tri-notatus* was collected in western China, it might serve as proof of the existence of *purpurascens* or *cyclurus* there, but, as far as I

know, none of the Chinese material recorded by Duméril and Bibron and credited to Gernaert came from that part of the country.

Dr. Cochran has very kindly examined the Formosan specimen of *formosanus* reported by Stejneger (1907, p. 356) as having a divided anal, and determined that in reality the plate is not divided but merely creased.

81. *Holarchus violaceus* (Cantor)

Figure 61

*Coronella violacea* Cantor, 1839, Proc. Zool. Soc. London, p. 50 (type locality, Rangpur, Bengal).

*Simotes swinhonis* Guenther, 1864, Rept. Brit. India, p. 215, Pl. xx (type locality, Amoy).

*Simotes* or *Oligodon* sp.? Swinhoe, 1870, Proc. Zool. Soc. London, p. 240 (Hainan).

*Simotes Swinhoei* Boettger, 1885, Ber. Offenbach. Ver. Naturk., XXIV-XXV, p. 146.

*Simotes violaceus* Boulenger, 1890, Fauna Brit. India, p. 312.—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 121 (Linping; Hsiaokeng; Shiuchow, all in Kwangtung).

*Holarchus dolleyanus* Cope, 1895, Proc. Acad. Nat. Sci. Phila., XLVI, p. 423, Pl. x (type locality, Hainan).

*Holarchus violaceus* Stejneger, 1907, Herp. Japan, p. 354, footnote (*H. dolleyanus* Cope considered a probable synonym of *H. violaceus*).

*Holarchus violaceus swinhonis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 212.

**Description:**—Upper labials 5 to 8, most frequently 8; preoculars 1 or 2; postoculars 2, rarely 1; anterior temporals 1, rarely 2; posterior temporals 1 or 2, very rarely 3; scales smooth, in 17 rows on the neck and at midbody, 15 before the vent, rarely reduced to 15 on the neck and at midbody and 13 before

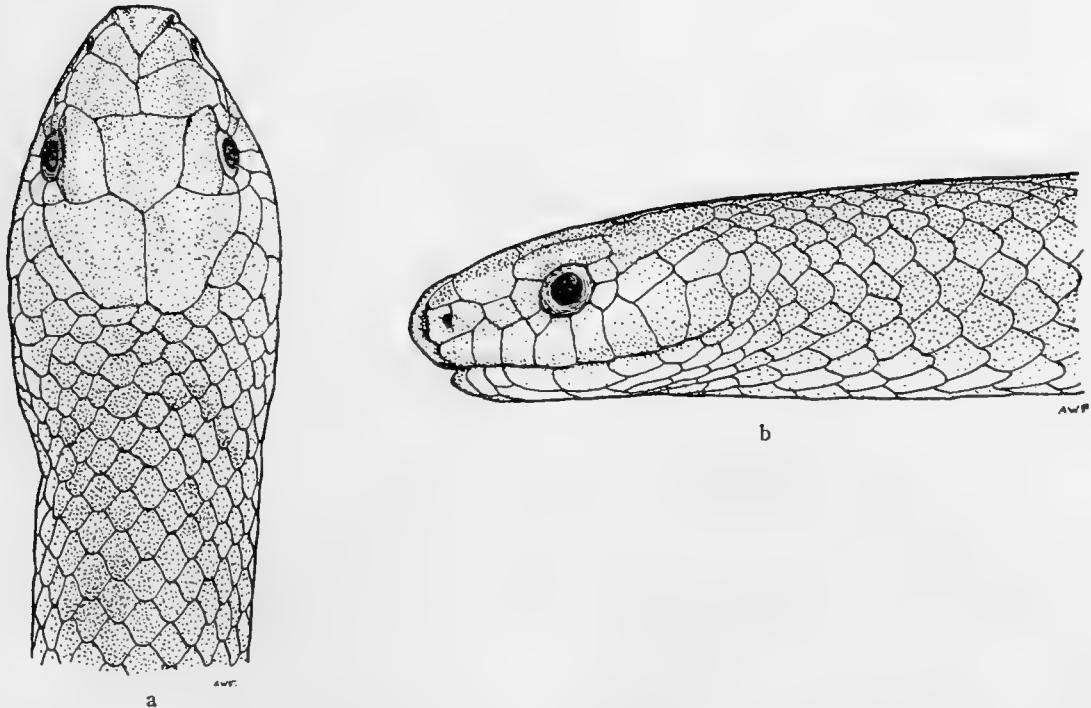


FIG. 61. *Holarchus violaceus*. x 3. a. Dorsal view of head. b. Lateral view of head. A.M.N.H. No. 27899 from Nodoo, Hainan.

the vent; ventrals 157-173; subcaudals 30-45; largest male 562, largest female 480 mm. in total length. Color reddish brown, many scales with dark margins; numerous narrow, dark cross-bands formed by dark-edged scales; head devoid of pattern, belly without markings. (Description based on forty-three specimens from Nodda.)

The ventral and subcaudal counts of ten males and eight females from Nodda (part of the series described above) average 164.3 and 168.1, 38.6 and 32.8, respectively, while the four largest males and females among thirty-two from the same locality measure 472, 462, 460 and 436; 429, 398, 392 and 381 mm. from snout to vent, respectively. These figures prove that, although this species exhibits, like most others, a higher ventral but a lower subcaudal average count in the female, it is unusual in having the larger maximum body length attained by the male.

Four Nodda specimens measure only 138, 135, 135 and 131 mm. from snout to vent. Such dimensions may be taken as representing the probable size at hatching.

Cope has inaccurately described (1895, p. 424) and figured (1895, Pl. xv, fig. 10) the hemipenis of a Hainan specimen of *violaceus*, so I am re-describing that of another example from the same locality; as follows:

The organ extends to the fourteenth subcaudal plate, is unforked, and devoid of spines. There is a poorly delimited but extensive area of smooth-edged calyces proximally. Distal to this, the walls adjacent to the sulcus are smooth and remarkably loose and elastic. They are, moreover, translucent and very thin. The walls farther removed from the sulcus are thicker and have more or less folded inner surfaces. Two large, papilla-shaped structures lie opposite one another in pockets of the thickened walls near the tip of the organ. The lips of the undivided sulcus are relatively conspicuous and uniform throughout.

*Distribution*.—In China, *H. violaceus* is apparently confined to the southeastern coastal region where it has been recorded as far north as Spider Island off the coast of Fukien, and Foochow. It has been secured as far inland as Yenping, in Fukien, and Shiuchow, in Kwangtung. There are many records for Hainan but none for Formosa.

Distributed from eastern Bengal and the Eastern Himalayas southeastward through the peninsula of southeastern Asia to Cambodia. Wall (1925, p. 815) gives Upper Burma records proving that *violaceus* ranges moderately close to the border of western Yunnan. He (1923, p. 319) questions its actual presence in Bengal.

*Habits and Habitat*.—Wall (1925, p. 814) states that *violaceus* "occurs throughout Burma in the plains, ascending to about 5000 feet into the hills,"

but, in southeastern China, it is apparently confined to the low, open coastal region. It is very abundant in the rolling grassy country about Nodoa, where I encountered it abroad nearly always in the late afternoon (Schmidt, 1927, p. 446).

The stomach contents of specimens from the Nodoa series may be tabulated as follows:

1. Three examples held remains of mygalomorph spiders.
2. One example held remains of lycosid spiders.
3. One example held remains of lycosid spiders including an egg sac, and an orthopterous insect.
4. One example held a larva of a beetle.

Meggitt (1931, p. 413) found insect (chiefly grasshopper) remains in the stomachs of fifteen specimens of *violaceus* from Thandaung, Burma. One of the fifteen also held a newt, another a viper's tooth. A specimen in the American Museum (No. 14181) contains a whip-scorpion of the family Thelyphonidae. These data are extremely interesting in view of the fact that Wall (1923, p. 306) summarizes the food of Indian species of *Oligodon* (including *Holarchus*) as "chiefly lizard's (or snake's) eggs and frog's spawn. Sometimes small mammals, lizards and other reptiles." He had no information on the feeding habits of *violaceus*.

*H. violaceus* is a docile snake that rarely attempts to bite but often coils tightly about one's hand and presses vigorously with the sharp tip of the tail. The end of the tail is sometimes curled into a complete circle. (Schmidt, 1927, l.c.; Wall, 1903, p. 93.)

On Hainan, one of these snakes became enraged when attacked by a young mongoose and struck so furiously that it drove the aggressor away repeatedly. Afterward, it struck at any object brought near and also vibrated its tail. (Schmidt, 1927, p. 447.)

A Nodoa female, measuring 395 mm. from snout to vent, contains 8 well-developed eggs with embryos still in the earliest stages of development. One egg is 19 x 10 mm. *H. violaceus* is certainly oviparous.

*Material examined*.—I have seen the following Chinese material: the type of *swinhonis* from Amoy, 1 specimen from Hainan, and 1 from Foochow, in the British Museum; 2 from Hainan (Tingan and the Wuchih Mts.), in the Museum of Comparative Zoölogy; 1 from Fukien, 1 from Yenping, 3 from Futsing Hsien, 43 from Nodoa, and 1 from an unknown locality, in the American Museum.

*Remarks*.—*H. violaceus* is discussed above, immediately following the generic key.

Genus *Oligodon* Boie

*Oligodon* Boie, 1827, Isis, p. 519 (type, *Coluber bitorquatus*).

This genus is discussed at length under *Holarchus*. The species of the *Oligodon-Holarchus* group, approximately sixty in number, are distributed from Baluchistan, the North-West Frontier Province and the Himalayas southward to Ceylon, eastward across Burma and southern China to Formosa, thence southward into the Malay Archipelago, including the Philippines.

Four species, although not recorded from China, have been collected near the Yunnan boundary. These are: *O. herberti* (Wall, 1923, p. 308, 1925, p. 813, and 1926, p. 563); *O. hamptoni* (Wall, 1925, p. 814); *O. torquatus* (Wall, 1923, p. 309, and 1925, p. 814; the type locality is Bhamo); *O. theobaldi* (Boulenger, 1888, p. 596; Wall, 1923, p. 322, and 1925, p. 815). Wall, 1923, p. 308, records that a specimen of *O. planiceps* "in the Indian Museum killed on the Yunnan Expedition is dubiously from Upper Burma or Yunnan."

Angel and Bourret have recently (1933, p. 138) described *O. lacroixi* from northern Tongking (Chapa). Their species is exceedingly closely allied to if not identical with *O. hamptoni* Boulenger, mentioned above. Angel and Bourret's alleged differences in lepidosis do not hold (Wall, 1925, p. 814, Sinlum Kaba specimen described), and only acquisition of additional material will demonstrate how much reliance can be placed on color pattern in this case, some forms of *Oligodon* exhibiting remarkable variation in coloration. Wall did not describe the pattern of his specimen. *O. hamptoni* is recognized at once by its lack of internasals and its low upper labial count (five, second and third entering orbit).

Steindachner's 1869 (p. 60) record of *Oligodon sublineatus* Duméril and Bibron from Amoy is without doubt an error, since this species is now known to be confined to Ceylon (Wall, 1923, p. 315). Through the kindness of Dr. Wettstein, I have been able to examine the specimen on which this record is based and can confirm its identification as *sublineatus*.

## OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Belly conspicuously marked with black and coral red; rostral very well developed; loreal absent; scales smooth, in 13 or 15 rows at midbody; anal divided.

## KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Internasals absent; scales in 13 rows at midbody..... *eberhardti*, p. 300
- II. Internasals normally present; scales in 15 rows at midbody..... *ornatus musyi*, p. 302

82. *Oligodon eberhardti* Pellegrin

*Oligodon Herberti* var. *Eberhardti* Pellegrin, 1910, Bull. Soc. Zool. France, XXXV, p. 30 (type locality, Tam Dao, northwest of Hanoi, Tongking).—Mertens, 1929, Bull. Antiven. Instit. Amer., III, p. 41 (Indo-China).

*Macrocalamus wongii* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 101, fig. 9 (type locality, Lohsiang, Kwangsi).



*Description*.—Upper labials 6, 3rd and 4th entering orbit; loreal absent; preoculars single; postoculars single; anterior temporals single; posterior temporals 2; scales smooth, in 15 rows on the neck, 13 on the body; ventrals in male 166, female 179; subcaudals in male 37, female 34; length of male 458 + 56, of female 396 + 54 mm. (Description based on the type and paratype of *Macrocalamus wongii* from Lohsiang.)

Mertens (1929, p. 41) describes two snakes from Indo-China as male and female with 174 and 187 ventrals, respectively, and identifies them as *O. herberti eberhardti*. He notes that, in his specimens, the third and fourth upper labials enter the orbit, while the type of *eberhardti* is described as having the second and third labials in contact with the eye. My notes on the type of *eberhardti* prove that, in it, the third and fourth labials enter the eye, the original description being slightly inaccurate. Without doubt, then, Mertens determined his material correctly. In fact, I can think of few snakes with only one labial anterior to the eye.

A translation of the original description of the type specimen, a male, follows:

The portion of the rostral visible above is equal to its distance from the frontal. The nasal is not divided. There are no internasals, the rostral being placed between the nasals and in contact posteriorly with the prefrontals. The frontal is considerably longer than its distance from the tip of the snout, its length equalling that of the parietals. The prefrontal is in contact laterally with the second labial. There is one preocular and one postocular, one elongated temporal followed by two other shorter ones. There are 6 upper labials, the second and third in contact with the eye; there are also 6 lower labials on each side, only the first meets the opposite one on a median suture, the fourth is by far the most developed. There are two pairs of chin-shields; the anterior, nearly twice as long as the posterior, are in contact in front with the first and second lower labials and laterally with the third and a part of the fourth. The scales are in 13 transverse rows on the body. There are 169 ventrals, 37 double subcaudals. The anal is divided.

The coloration is of the most characteristic: the general color of the body above is grayish brown, with a dark brown longitudinal line on each side stippled above with light, and mid-dorsally a longitudinal series of lozenge-shaped spots, light gray, bordered by sombre blackish brown sides, forming well-defined X's. An oblique whitish collar on each side of the neck extends forward on the parietals. The head is dark brown, with two light spots, one before and one behind the eye. On the tail, the median spots run together to form a light vertebral line, bordered with blackish. The ventral plates underneath the body are now coral red, now half coral red and half black, now completely black, thus forming a very agreeable alternating design; the red color predominates on the subcaudal plates. Length:  $372 + 66 = 438$  mm.

*Distribution*.—*O. eberhardti*, as treated here, is known from Lohsiang in Kwangsi; and the type locality in Tongking.

Angel's (1929, p. 79) *O. herberti* from northern Laos probably constitutes another record of *eberhardti*, and Mertens (1929, l.c.) suggests that Werner's

(1924, p. 37) Cambodian example likewise belongs here. It was also identified as *herberti* by Werner, and described as having 165 ventrals and 32 subcaudals.

*Habits and Habitat*.—Judging by the locality records, this species inhabits mountains. The altitude of the type locality is 900-1200 meters (Delacour and Jabouille, 1931, p. xxxviii).

*Material examined*.—I have seen the type of *eberhardti*, in the Paris Museum.

*Remarks*.—Fan's *M. wongii* without doubt belongs in the genus *Oligodon*, but I cannot prove beyond question that it is identical with *eberhardti*. However, the only scale character that I can find to separate the material on which these names are based is the nuchal scale row count of 15 in *wongii* compared to 13 in *eberhardti*, and this very probably is due more to the individual method of counting than to an actual difference in number of rows. There are also some details in the color descriptions that do not seem to agree, but I cannot believe that these are important enough to warrant recognition of two forms in the face of the many points of agreement and the relative proximity of the type localities.

Examination of the two cotypes and two additional examples of *O. herberti* Boulenger, 1905, p. 235, in the British Museum, as well as the type of *eberhardti*, as mentioned above, has convinced me that two distinct species are involved. The descriptions of *herberti* are incomplete but the following data are well established: the ventral count of females of this species ranges from 200 to 212, of males from 187 to 191, while the corresponding figures for *eberhardti* are 179 to 187 and 166 to 174. Thus there is no intergradation, while the differences in coloration are considerable. Boulenger's counts and sexing of the *herberti* cotypes are in part erroneous, but Mr. Parker has kindly furnished me with accurate data on them as follows:

♂	187 (190) ventrals	40 subcaudals
♂ (♀)	191 (189) ventrals	37 subcaudals

The sign and figures in parentheses are those of Boulenger. In addition to the original description, the following references to *herberti* have been consulted: Wall, 1921, p. 44; 1923, p. 308 and pp. 467 and 626; 1925, p. 813; and 1926, p. 563.

### 83. *Oligodon ornatus musyi* (Roux)

Figure 62

*Simotes musyi* Roux, 1919, Rev. Suisse Zool., XXVII, p. 61, figs. 1 and 2 (type locality, Fukien).

*Holarchus musyi* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 452, fig. 14 (Chungan Hsien, Fukien).

*Holarchus ornatus musyi* Mell, 1931, Lingnan Sci. Journ., VIII, p. 211.

*Description*.—Upper labials 6, 3rd and 4th entering orbit; loreal absent; preoculars 1, rarely 2; postoculars 2, occasionally 1; anterior temporals 2, very

rarely 1; posterior temporals 1 or 2; scales smooth, in 15 rows throughout; ventrals in males 170-172, females 172-182; subcaudals in males 36-40, females 27-34; 7-9 cross-bands on body, 1 or none over vent, and 2 on tail; length of males 508+88, 497+85, 480+84, 440+85 and 434+82, females 452+55, 405+58, 330+51 and 183+23 mm. (Description based on nine specimens from Chungan Hsien.)

A distinct red stripe is always evident along the middle of the ventrum. In one Chungan Hsien example, the internasals are only partly sutured off.

The meager data given above suggest that the males attain a greater size than the females. This interesting point should be checked on a much larger series, however.



FIG. 62. *Oligodon ornatus musyi*.  $\times 3$ . a. Dorsal view of head. b. Pattern of body. A.M.N.H. No. 33756 from Chungan Hsien, Fukien.

A translation of the original description of the type specimen, a male, follows:

Nasal divided; rostral large, the portion visible from above shorter than that separating this plate from the frontal. Suture between the internasals shorter than that between the prefrontals. Frontal a little longer than broad, longer than the distance which separates it from the tip of the snout, shorter than the parietals. Loreal absent, prefrontal in contact with the second upper labial. One preocular, two postoculars, no subocular. Temporals 1+2. Six (or seven?) upper labials, the third and the fourth entering the eye. The fifth, very large, presents on its upper edge a notch and a very short incision, which seems to indicate that this large plate results from the fusion of two normal plates. This peculiarity is observed on both sides of the head. The anterior lower labials in contact behind the short and triangular mental. Four lower labials in contact with the first sub-maxillaries which are larger than the second sub-maxillaries (proportion 3:2). Scales of the body in 15 rows. Ventrals 172; anal divided, subcaudals 44.

The animal is of a brownish gray above with faint indication of three, lighter longitudinal lines of which the median, comprising only one row of scales, is the most distinct. On the body and tail are 12 chestnut-brown spots forming transverse ribbons of which the widest are composed of two contiguous lozenges; adjacent to each lozenge is a lance-head figure which descends on to the side of the body. The entire ribbon thus presents approximately this figure:

◀◊◊▶. The body has ten of these ribbons and the tail only two. Between these ribbons a number of small, elongated, black-brown spots are discernible here and there. On the front of the rostral is a curved black mark. The nasal and the first upper labial are also spotted, as are the lower labials. A curved brown band between the eyes descends onto the 3rd, 4th, and 5th upper labials. Behind this band is another occupying the posterior portion of the frontal and descending obliquely on each side of the body, becoming wider and passing behind the buccal commissure. Farther back, on the occiput, is a median spot in the form of an arrow of which the point, directed forward, lies at about the middle of the interparietal suture. The two corners of the arrowhead are rounded, ending on the seventh or eighth transverse series of the dorsal scales. The ventrum is of a yellowish white spotted with black. These spots, square or quadrangular, are distributed alternately or in pairs on the ventral plates. The tail is likewise spotted, as is the greater part of the mentals. Total length 450 mm. (head and body 380, tail 70).

The hemipenis is not forked and extends to the eighth to ninth subcaudal plates. It is spinous throughout, the spines of the proximal two-thirds being uniform in size, shape and distribution. Each spine is short and thick, but distinctly compressed laterally, so that its anterior and posterior edges are somewhat blade-like in form. All the spines are reduced in size near the tip of the organ. Two longitudinal rows of compact spines are evident on its distal third, each row well removed from the other and from the sulcus but not very sharply differentiated from the adjacent spines. The lips of the undivided sulcus are prominent and bear numerous small spines, save near the base of the hemipenis. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—This form is known only from Fukien where it has been definitely recorded from Chungan Hsien.

*Habits and Habitat*.—I secured *musyi* only in the high mountains about Kuatun and Sanchiang, so it is probably an inhabitant of forested mountains at considerable altitudes.

One Chungan Hsien specimen had eaten about six similar eggs of some reptile. This is interesting in view of the fact that many other species of *Oligodon* (including *Holarchus*) also eat reptile eggs (Wall, 1923, p. 306).

*Material examined*.—I have seen the 9 specimens from Chungan Hsien, in the American Museum, while Karl P. Schmidt has kindly examined and re-sexed for me the type of *musyi*, in the Basel Museum.

*Remarks*.—Maki (1931, p. 134, figs. 88 and 89, Col. Pl. L) has recently re-described the typical or Formosan form of this beautiful snake. The two subspecies differ only in ventral count, that of the insular form being somewhat lower (156-173).

#### Genus *Calamaria* Boie

Although *Calamaria* is represented in the Malay Archipelago and Penin-

sula by innumerable species, those treated below are the only ones found on mainland Asia north of the Malay Peninsula. *C. pfefferi* Stejneger occurs in the Riu Kiu Islands.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Size small; head not distinct from neck; no internasals; no loreal; no temporals; 4 upper labials; scales smooth, in 13 rows throughout; secretive; inoffensive.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Frontal longer than broad; tail tapering to a point. . . . . *p. pavimentata*, p. 305  
 II. Frontal as long as broad; tail blunt. . . . . *septentrionalis*, p. 306

#### 84. *Calamaria pavimentata pavimentata* Duméril and Bibron

Plate XII, H, I and J

*Calamaria pavimentata* Duméril and Bibron, 1854, *Erp. Gén.*, VII, p. 71 (type locality, Java).—Fan, 1931, *Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ.*, No. 11, p. 105 (Lohsiang, Kwangsi).

*Calamaria Siamensis* Boettger, 1885, *Ber. Offenbach. Ver. Naturk.*, XXIV-XXV, p. 121 (Canton region).

*Calamaria berezowskii* Guenther, 1896, *Ann. Mus. Zool. Acad. Sci. St. Pétersbourg*, I, p. 205, Pl. 1 (type locality, Lungan, Szechwan).

*Description*.—Rostral distinctly visible from above; frontal longer than broad; upper labials 4, 2nd and 3rd entering orbit; preoculars single; postoculars single; scales smooth, in 13 rows throughout; tail pointed; ventrals and subcaudals, in three Szechwan specimens, 155-171 and 13-22, respectively (although two of these three Szechwan specimens have not been sexed, it is probable that the numbers 155 and 22 represent male, 167-171 and 13-14 female, counts); total length and tail length of the two Szechwan specimens not sexed, 290 and 245, 18 and 25 mm., respectively. Color reddish brown above with dark longitudinal lines or rows of spots; a yellowish collar on neck and 2 pairs of small, white spots more or less evident on tail.

*Distribution*.—This snake is extremely rare in China where it has been found with certainty only at Lungan and Muping, in Szechwan; Lohsiang, in Kwangsi; and the region of Canton in Kwangtung.

Distributed from Assam and central China southward into the Malay Archipelago (Sumatra and Java).

*Habits and Habitat*.—This species ascends to considerable altitudes in China (Muping, 4500 feet) as well as on the Malay Peninsula (Pahang, about 5500 feet, Smith, 1922, p. 267). Flower (1899, p. 675) found it as low as 800 feet on the Malay Peninsula, however, so we may conclude that, like *septentrionalis*, it occurs at a great range of altitudes.

*Material examined*.—The only Chinese material that I have seen is one specimen from Muping, in the U. S. National Museum.

*Remarks*.—Stejneger (1907, p. 376) reported a Formosan snake as *C. berezowskii*, but Steindachner (1913, p. 341), on the basis of a large series from that island, concluded that Formosan material should be called *pavimentata*. Recently, Maki (1931, p. 136) has named the Formosan form *C. pavimentata formosana*, putting *berezowskii* unconditionally in the synonymy of this new subspecies. Judging from his text, however, he did not mean to relegate *berezowskii* to the synonymy of his new form, but only the Formosan *berezowskii* of Stejneger, Oshima, Okada and Takahashi as listed in his synonymy. The real point of interest to the present work is the relative abundance of *pavimentata* on Formosa, contrasting so strongly with its apparent absence in Fukien and Chekiang and its scarcity in China generally.

The name *berezowskii* still stands available for Chinese material should it prove to be distinct from that of more southern origin. I have not as yet found any constant difference, but few specimens have come under my observation for comparative study.

#### 85. *Calamaria septentrionalis* Boulenger

Plate XII, K, L, M, N, O and P

*Calamaria quadrimaculata* Guenther, 1888, Ann. Mag. Nat. Hist., (6) I, p. 169 (Lushan, Kiangsi) (not of Duméril and Bibron, 1854).

*Calamaria septentrionalis* Boulenger, 1890, Proc. Zool. Soc. London, p. 34 (type localities, Kiukiang [region] and Hongkong); 1894, Cat. Snakes Brit. Mus., II, p. 349, Pl. xx (Chusan Is. and mainland opposite, Chekiang; and type localities).—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 26 (Wuhu, Anhwei; Fukien).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 122 (Chayuan-shan, Kwangtung, 500 meters).—Werner, 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 48 ("Hangaodsu" mountain, between Ningtu and Kingan, Kiangsi).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 91 (Mokanshan, Chekiang; southwestern Hunan; Foochow).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 106 (Lohsiang and Chinhsiu, Kwangsi).

*Calamaria pavimentata* Mell, 1922, l.c. (Lienshan, northwestern Kwangtung) (not of Duméril and Bibron, 1854).

*Description*.—Boulenger's (1894, p. 349) description, obviously based on the cotypes and two examples from Chekiang, follows:

Rostral broader than deep, not or hardly visible from above; frontal as broad as long, shorter than the parietals, about twice and a half to three times as broad as the supraocular; one præ- and one postocular; the diameter of the eye nearly equal to its distance from the mouth; four upper labials, second and third entering the eye; first pair of lower labials forming a suture behind the symphysial; two pairs of chin-shields, in contact with each other. Scales in 13 rows. Ventrals 148-177; anal entire; subcaudals 9-17. Tail rounded at the end. Blackish brown above, with three longitudinal series of small black spots; each scale of the outer row with a whitish spot; a yellow nuchal collar, interrupted in the middle, and a pair of yellow spots at the base of the tail; lower parts uniform coral-red, with a black line along the middle of the tail. Total length 300 mm.; tail 13-22.

The scales are smooth and in 13 rows throughout.

Fan's (1931, p. 107) figures for fourteen specimens of each sex from Yaoshan well illustrate the marked sexual differences as follows: ventrals in

males 154-164, females 174-187; subcaudals in males 14-18, females 8-9; average proportionate tail length in males .07, in females .02.

The females exceed the males in size (Pope, 1929, p. 454).

The hemipenis is deeply forked, devoid of spines, and extends to the seventh to eighth subcaudal plates. It is smooth proximal to the point of forking, but calyculate beyond. The calyces are pocket-like in shape and uniform in size. Their edges are not scalloped. A broad longitudinal fold extends from the point of forking to the tip of the organ. The lips of the sulcus are smooth and moderately prominent. (Description based on a specimen from Lohsiang.)

*Distribution*.—*C. septentrionalis* is known from the following localities in China:

Anhwei: Ningkwo; Wuhu.

Chekiang: Chusan Is. and mainland opposite; Mokanshan.

Kiangsi: Lushan; Pingsiang; "Hangaodsu" mountain, between Ningtu and Kingan; Nanan.

Fukien: Chungan Hsien (including Kuatun); Yenping; Foochow.

Kwangtung: Chayuanshan; Lienshan.

Hainan: northern Hainan.

Kwangsi: Lohsiang; Chinhsiu.

Hunan: southwestern Hunan.

This species is also known from Tongking, so its entire range extends from northern Kiangsi and Chekiang, and southern Anhwei, southwestward to Hainan and Tongking.

*Habits and Habitat*.—It is hard to define the habitat of *septentrionalis* because records indicate that it occurs in mountains as well as flat regions and at both low and high altitudes. Boulenger (1899, p. 165) lists a specimen from Kuatun, where I failed to find it, although a specimen was brought to me there from a lower region a few miles distant. Fan (1931, p. 107) reports it as "exceedingly abundant in Yaoshan," and, indeed, this record is of special interest, for at last a favorite habitat of this elusive snake has been found. Fan goes on to say that it prefers bamboo thickets and other tall vegetation. In Anhwei, I found it in an open, intensively cultivated region at low altitude, while the Nanan specimens were secured during excavation for a building in Nanan. All observations support the conclusion that *septentrionalis* is secretive and spends much of its time beneath the surface.

A specimen from Mokanshan held 2 well-developed, elongate eggs with very small embryos. One egg measured 22 x 5 mm. The species is probably egg-laying.

Schmidt (1927, p. 538) recorded the behavior of a specimen as observed by me in Anhwei as follows:

Another specimen, when put on the floor, was able to progress in regular snake-fashion. When held by the tail it continued to try to escape. When its head was held to the floor, the whole body was instantly thrown forward, wrapped around the restraining fingers, and the tip of the tail was repeatedly pressed against them. It seems that the tail takes the offensive while the head invariably tries to escape! The tail, in short, not only mimics the head in form and color pattern, but in behavior as well.

Mell (1929, p. 249, fig. 12) has discussed the possible significance of the odd behavior of this snake in correlation with the striking similarity of the tail to the head in form as well as pattern. Further and more detailed field observations are needed.

Fan (1931, l.c.) states that, when annoyed, *septentrionalis* attempts to bite.

*Material examined*.—I have seen the following material: 8 specimens from Anhwei, 2 from Fukien, and 9 from Kiangsi, in the American Museum; 1 from Kuatun, 2 from Chekiang, 2 from Tongking, and the type series, in the British Museum; 1 from Hainan, in the Naturhistorisches Museum, Vienna; 1 from Pingsiang and 2 from Lohsiang, in the Museum of Comparative Zoölogy; 3 from Hunan, 3 from Mokanshan and 1 from Foochow, in the U. S. National Museum.

#### Subfamily HOMALOPSINÆ

This subfamily is represented in China with certainty by only one genus.

Boettger's (1888, p. 84) record of *Homalopsis buccata* for Hongkong was founded on a specimen in the Hongkong City Hall Museum, the correct identification of which was later corroborated by Wall (1903, p. 94), who has, however, shown that records based on material in this Museum are to some degree unreliable (1903, p. 84). The Hongkong snake tentatively identified by Hallowell (1860, p. 504) as *H. buccata* has since been re-determined as *Lycodon subcinctus* (Stejneger, 1925, p. 90). *Hurria rhynchops* very probably should be deleted from the fauna of Formosa, since Maki (1931, p. 68) has no new material to list.

#### Genus *Enhydris* Latreille

This genus is distributed from Peninsular India through Burma, southern China, the peninsula of southeastern Asia and the Malay Archipelago to northern Australia.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Nostrils superior; internasal normally single; scales smooth; aquatic.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Scales in 19 rows at midbody; two upper labials entering eye. . . . . *plumbea*, p. 315
- II. Scales in 21 to 25 rows at midbody (very rarely 19 in *enhydris*); a single upper labial entering eye
  - A. Scales in 23 or 25 rows at midbody. . . . . *chinensis*, p. 311



B. Scales in 21 rows at midbody (rarely 23 in *enhydris*)

1. Dorsum grayish olive with two rows of irregular, black spots which may be more or less transversely or longitudinally connected..... *bennettii*, p. 309
2. Dorsum uniform grayish olive or grayish brown with or without two light longitudinal lines..... *enhydris*, p. 314

Boulenger (1896, p. 5) describes *plumbea* as having either the 4th or the 4th and 5th labials entering the eye, but in every one of 188 specimens in the American Museum (184 from China and 4 from elsewhere) two labials regularly enter the orbit. It is interesting in this connection to note that only one labial enters the eye in all of the 111 Chinese specimens of *chinensis* in the American Museum.

86. *Enhydris bennettii* (Gray)

Plate XII, A, B, C, D, E, F and G

*Hypsirhina Bennettii* Gray, 1842, Zool. Misc., p. 67 (type locality, China).—Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 81 (Hainan).

*Hypsirhina maculata* Duméril and Bibron, 1854, Erp. Gén., VII, p. 950 (type locality, China).

*Hypsirhina enhydris* var. *maculata* Jan, 1868, Icon. Ophid., Livr. 30, Pl. iv.

*Enhydris bennettii* Stejneger, 1907, Herp. Japan, p. 302, figs. 263-265 (Hongkong?).—Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 203 (Hoihow, Hainan).

*Description*.—Stejneger's (1907, p. 302) description of a male, probably from Hongkong, follows:

Rostral somewhat broader than high, visible from above; internasal single, widely separated from rostral by nasals, small, not much broader than long, widely separated from loreal; prefrontals smaller than nasals, in contact with them and with supraoculars; frontal somewhat shorter than its distance from tip of snout, nearly twice as wide as supraoculars at center of eye; parietals rather broad, the lateral outline irregular and showing evidence of fusion with adjacent scales; nostrils semilunar, on top of snout, in a large nasal which on the left side is semidivided by a suture from nostril to first labial; nasals broadly in contact with each other behind rostral with prefrontals and first supralabials; loreal trapezoid, longer than high, in contact with first three supralabials; one preocular, not in contact with frontal; eye small, its diameter less than distance from edge of lip; two postoculars; 1 + 2 temporals; 8 supralabials, increasing in height backward to the sixth, which is highest, first in contact with loreal, thus excluding nasal from second, fourth entering eye; three lower labials in contact with anterior chin-shields, which are followed by two pairs of smaller chin-shields, both separated by scales; 21 rows of smooth scales without pits; 164 ventrals; anal divided; 54 subcaudals. Color (in alcohol) above drab gray, with two series of irregular dark brownish gray dorsal spots, which anteriorly unite into short crossbars and on the neck into a median longitudinal dark band; outer four scale rows white, the first and fourth having their lower and upper edge respectively margined with dark gray, forming an upper and lower dark indented edge to the lateral white band; labials and whole underside whitish, each scale and scute edged with dark gray, the ventrals with a median series of dark spots formed by a projection of the dark basal edge, and a similar arrangement on the subcaudals, causing a zigzag longitudinal dark band on the median line of the underside of the tail. Total length 377 mm.; snout to vent 314; vent to tip of tail 63.

Table XLI records all of the more important available data on eight of the ten known specimens. One of the remaining two is described above; for the other there are no data available.

TABLE XLI. LEPIDOSIS AND DIMENSIONS OF *ENHYDRIS BENNETTII*

Locality	Sex	Number of Specimens	Upper Labials	Upper Labial Entering Eye	Preoculars	Postoculars	Anterior Temporals	Posterior Temporals	Scale Rows at Midbody; or on Neck, at Midbody, and before Vent	Ventrals	Subcaudals	Length in Millimeters	Reference
China....		2							21	155-162	47-51	548+100 (the larger)	Duméril and Bibron, 1854, p. 950
Hainan...		1							21	160	57		Boettger, 1888, p. 81
China....	♂	1	8	4th	1	2	1	2	21-21-15	163			Boulenger, 1896, p. 8 (type)
China....	♂	1	8	4th	1	2	1	2	21-21-16 (15)	161	53		Boulenger, 1896, p. 8
Hoihow...	♀	2	7						21-21-15	156-157	48	both 595	Smith, 1923, p. 203
Hoihow...	♂	1	7						21-21-16	158	50		Smith, 1923, p. 203

Boulenger's ventral and subcaudal counts given in the table are open to doubt, as they do not agree with Guenther's (1864, p. 283) counts though obviously based on the same material.

In the four specimens from Hainan examined, the reduction from 21 to 19 rows of scales takes place opposite the 52nd to 65th ventral plates counted forward from the vent. There are never more than 21 rows of scales anywhere on the body.

The deeply forked hemipenis is spinous proximally, the spines gradually becoming papilla-like distally as in *chinensis*. (Specimen in British Museum credited to Bowerbank examined.)

*Distribution*.—*E. bennettii* is known with certainty only from Hainan but there is a Hongkong record. Its reported presence on Formosa may now be discredited (Maki, 1931, p. 67).

*Habits and Habitat*.—Dr. Malcolm Smith has told me that his *bennettii*

were taken in the sea along with sea-snakes near the coasts of Hainan. This probably means that *bennettii* inhabits the low coastal plain of Hainan and is frequently washed out to sea by freshets. A thorough study of the stomach contents of this species might prove to be of special interest.

According to Dr. Smith, this is not really a rare snake on Hainan.

*Material examined*:—I have seen the type and 1 other Chinese specimen, in the British Museum; 1 from Hainan, in the Senckenbergisches Museum, Frankfurt; 1 probably from Hongkong, in the U. S. National Museum; and 3 from Hainan, in the Smith Collection.

#### 87. *Enhydris chinensis* (Gray)

Plate XIII, A, B and C

*Hypsirhina Chinensis* Gray, 1842, Zool. Misc., p. 66 (type locality, China).—Boettger, 1885, Ber. Offenbach. Ver. Naturk., XXIV-XXV, p. 123 (Canton region); 1888, XXVI-XXVIII, p. 82 (Canton and Hainan).—Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 8, Pl. 1 (Ichang, Hupeh; an erroneous Hoihow record; China).

*Hypsirhina sinensis* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 30 (Fukien); 1916, XLVII, p. xiii (Changning, Kiangsi); 1917, XLVIII, p. xii (Hoihow, Hainan).

*Enhydris chinensis* Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 203 (Hoihow, Hainan).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 79 (Foochow, and Futsing Hsien, Fukien).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 456 (Futsing Hsien, Foochow, Yenping and Chungan Hsien, in Fukien; Hokow, Kiangsi).—Chang and Fang, 1931, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VII, p. 263, fig. 7 (Wenchow, Chekiang; Nanking).

*Description*:—Internasal single, very rarely in contact with loreal; upper labials 8, very rarely 9, 4th entering orbit; preoculars single; postoculars 2; anterior temporals single; posterior temporals 2; scales smooth, varying from a maximum of 25 rows anteriorly to a minimum of 17 posteriorly, the two usual formulas being 25-23-21-19 and 23-21-19; ventrals in twenty-six males 135-147, in twenty females 134-141; subcaudals in twenty-six males 40-52, in nineteen females 35-43. Color olive above with numerous black spots variable in size but arranged in longitudinal series and tending to be concentrated along the middle of the back and on either side of the body; yellow below, each ventral with a dark edge. (Description based on forty-six examples from Hainan.)

The above description agrees well with one based on seventy-five specimens from Fukien and northeastern Kiangsi, save that, in the more northern material, the ventral and subcaudal ranges, respectively, are as follows: seven males 146-151, eight females 141-146; six males 46-50, eight females 37-42. In the entire series of seventy-five, the three largest males measure 390, 384 and 380, the three largest females 500, 480 and 480 mm., from snout to vent (Pope, 1929, p. 456). The largest specimen in the Hainan series of forty-six specimens described above was also a female 567 mm. long; the largest male measured 516 mm. (Schmidt, 1927, p. 450).

In very small examples the black spots stand out more vividly against the

ground color than in the adults, and the tendency of these spots to coalesce and form lines on the neck is very noticeable.

Most of the scales and plates of the head and all those of the tail and cloacal region are conspicuously tuberculate in the adult male but smooth in the female. The scales of the cloacal region and the tail bear many tubercles apiece, a condition found only in this one species of the Chinese ophidian fauna.

The hemipenis is spinous, extends to the ninth to tenth subcaudal plates, and is forked opposite the fifth. Proximally, the spines are compressed and recurved. They decrease in size until about the middle of the organ, where they increase in number, become gradually papilla-like in form, and continue to the end without reduction in size or number. The sulcus is not forked and is moderately prominent. (Description based on a Hainan specimen.)

*Distribution*.—*E. chinensis* is known from Formosa and the following localities in China:

Hupei: Ichang.

Kiangsu: Nanking.

Chekiang: Wenchow.

Kiangsi: Hokow; Changning.

Fukien: Chungan Hsien; Yenping; Foochow; Kuliang; Futsing Hsien; Amoy; southern Fukien.

Kwangtung: Chonglok; Lilong; Canton.

Hainan: Hoihow; Nodda.

Kreyenberg secured a specimen at Tsingtao (see also *Natrix percarinata*), but I believe his record is open to doubt, and, in fact, it would be satisfying to receive confirmation of the actual occurrence of this species at Nanking, not to mention Ichang.

Steindachner (1869, p. 68) records *chinensis* from Singapore, and Boulenger (1896, p. 9) examined Bangkok specimens, but more recent works agree in omitting it from the fauna of regions south of China. Chinese individuals are no doubt constantly present in the medicine shops of Bangkok, and those seen by Boulenger might well have had such an origin.

*E. chinensis* occurs on Formosa (Maki, 1931, p. 66).

*Habits and Habitat*.—This snake is extremely common in the low, flat, cultivated country of the Chinese seaboard and the Hainan plain. It ascends to considerable altitudes on the Chungan plateau and in northeastern Kiangsi. Although it avoids a true mountain environment, it is present in the more open valleys of the Yenping range wherever rice fields abound. The Kuatun and Sanchiang mountains are apparently too high for it (Pope, 1929, p. 457). Mell (1922, p. 122) reports it as very common in all kinds of quiet or slowly moving water (ponds, canals, etc.) of southern Kwangtung below 200 meters altitude.

*Enhydris chinensis* feeds on fishes. It has been known to eat the following

species: *Macropodus viridiauratus*, *Erythrocultus aokii* and *Carassius* or *Cyprinus* species (Pope, 1929, l.c.); *Anabas scandens* (Chang and Fang, 1931, p. 264).

Others (Schmidt, 1927, p. 450, and Mell, 1929, p. 239) have recorded evidence of its eating fishes without giving identifications.

I secured a female with 6 fully-developed embryos on July 30 at Nodua (Schmidt, 1927, p. 450). Farther north, on the mainland, two females with well-developed embryos were taken in Futsing Hsien the last week of August or later, while gravid specimens were found near Yenping in May and on the Chungan plateau in June. Judging by the number of Futsing Hsien females without young, and the advanced state of the embryos of the only two gravid ones, it must be concluded that, in 1925, the birth season there was nearly over by early September (Pope, 1929, l.c.). Maki (1931, p. 67) records a Formosan specimen giving birth to 13 young on August 27.

Seventeen females from Fukien hold from 3 to 13 young and average 5.7 apiece (Pope, 1929, l.c.), while three from Foochow and Kuliang in the U. S. National Museum contain 3, 7 and 8 young, respectively. One of the fully-developed Hainan embryos mentioned above measured 157 mm., while two well-advanced ones from the Futsing Hsien females already referred to measure 155 and 165 mm., from snout to end of tail. These figures must represent the approximate size at birth because four Futsing Hsien individuals collected already fending for themselves are only 166, 171, 174 and 178 mm. in total length, respectively.

No egg-tooth is evident on any of five embryos obviously on the point of birth. The parent is American Museum No. 33873 from Futsing Hsien.

The following account of the behavior of *chinensis* is based on my Hainan observations (Schmidt, 1927, l.c.):

When picked up suddenly with a pair of forceps, this snake makes wild efforts to bite, waving its open jaws about and sometimes biting itself. When teased in a box, it would actually spring about, jumping clear of the bottom and advancing as much as a foot at each jump. After a few wild efforts it would subside and assume a defensive posture striking viciously at any object brought near. At such times the body is flattened. On a smooth floor it progresses rapidly with a series of crawling 'leaps,' the body being apparently raised clear of the floor with every spasmodic motion.

The behavior of *chinensis* is strikingly like that of *E. sieboldii* as described in detail by Wall (1907, p. 118). Mell (1929, p. 253) has also referred to the characteristic actions of *chinensis*.

The thoroughly aquatic habits of this interesting species are shown not only by its food and habitat preferences but by the following observations (Schmidt, 1927, l.c.):

A large female was kept in a water-jar and the frequency of respirations observed. If

given half a chance these snakes make for water, and they lie contentedly at the bottom, nearly motionless, if placed in a water-jar. Seven intervals between respirations varied from ten to fifteen minutes, averaging between thirteen and fourteen minutes. Respiration occupied from one to five minutes, only the tip of the snout being exposed.

*Material examined*.—I have seen the following material: 46 specimens from Hainan, 73 from Fukien, and 2 from Kiangsi, in the American Museum; 1 each from Hainan, Hongkong, Amoy and Ichang, 3 from southern Fukien, 2 with no more definite locality than China, and the type, in the British Museum; 4 from Canton, 2 from Hainan, and 1 from Tsingtao, in the Senckenbergisches Museum, Frankfurt; 1 from Canton, in the Museum of Comparative Zoölogy; 1 from Futsing Hsien, 3 from Foochow, and 1 from Kuliang, in the U. S. National Museum.

88. *Enhydris enhydris* (Schneider)

Plate XIII, D, E, F, G, H and I

*Hydrus enhydris* Schneider, 1799, Hist. Amphib., I, p. 245 (based on Russell's Ind. Serp., I, p. 35, Pl. xxx; type locality, Ankapilly Lake, India).

*Hypsirhina bilineata* Gray, 1842, Zool. Misc., p. 66 (type locality, China).—Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 274 (Hongkong).

*Description*.—Internasal single, in contact with loreal; upper labials 8, 4th entering orbit; preoculars single; postoculars 2, rarely 1; anterior temporals single; posterior temporals 2; scales smooth, usually in 21, sometimes 19 or 23 rows; ventrals 150-177; subcaudals 47-78. Color brown, olive, or dark gray above, with two light longitudinal bands more or less distinct; whitish below with a dark line along either side and usually a third one down the middle of the belly. Total length 680, tail 135 mm. (Description based on that of de Rooij, 1917, p. 181.)

The only Chinese example on record, a male, has 161 ventrals and 63 subcaudals, while these counts for a Hongkong female are 155 and 47 (Boulenger, 1896, pp. 7 and 8).

*Distribution*.—This species has been recorded from China without definite locality and from Hongkong. Its distribution as far north as extreme southern China is corroborated by its presence in Tongking near Haiphong (Angel, 1927, p. 496).

Distributed from northeastern India to Assam and Burma southward through the peninsula of southeastern Asia into the Malay Archipelago and even to New Guinea.

*Habits and Habitat*.—Wall (1912, pp. 1017-1021) has given an excellent account of this snake, in which he brings out the following points of special interest:

1. It is thoroughly aquatic, inhabiting rivers, estuaries, lakes, marshy ground and even rice fields (p. 1019).
2. It is timid (p. 1019).
3. Cantor has stated that it feeds on fishes (p. 1019).
4. A female was seen to give birth to 11 young, two of which measured 152 and 165 mm., while another contained 6 eggs. This latter female was taken near Rangoon in March (pp. 1019-1020).

Smith (1914, p. 126), working in Bangkok, records the following notes on the breeding of *enhydris*:

I obtained a female in the month of December showing enlarged ovarian follicles, in which the embryos, 10 in number, could be just discerned. I received another gravid female in April, containing 18 young ones, their development in this case being well advanced. The mother was a very large specimen measuring 680 mm. in length. A third was caught in July, which gave birth to a single still-born young one, probably the last of her brood.

The same authority (1914, p. 100) supplies the following note on the feeding of this species:

It appears to subsist chiefly on fish, but Mr. Herbert informs me that he once caught one which disgorged a skink (*Mabuia*), a very unusual meal, I should think, for this snake.

#### 89. *Enhydris plumbea* (Boie)

Figure 63

*Homalopsis plumbea* Boie, 1827, Isis, p. 550 (type locality, Java).

*Hypsirhina plumbea* Gray, 1842, Zool. Misc., p. 66.—Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 5 (China; an erroneous record for Hoihow; Hongkong; Formosa).

*Enhydris plumbea* Stejneger, 1907, Herp. Japan, p. 300, figs. 260-262 (Formosa); 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 80 (Foochow, Kuliang, Futsing Hsien, and near Yenping, in Fukien; Wenchow, Chekiang).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 455 (Futsing Hsien, Foochow, Yenping, Kienning, and Chungan Hsien, all in Fukien).

*Hypsirrhina plumbea* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 122 (Wuyung, Kwangtung; and mountains of the northern boundary of Kwangtung to 700 meters).

*Description*.—Internasal single, not in contact with loreal; upper labials 8, 4th and 5th entering orbit (number of labials entering orbit determined in only one hundred and two specimens); preoculars 1, rarely 2; postoculars 2, very rarely 1; anterior temporals single; posterior temporals 2, very rarely 1; scales smooth, 19-17, but occasionally reduced to 15 or 16 before the vent; ventrals in fifty-seven males 125-136, in fifty-five females 123-132; subcaudals in fifty-three males 36-42, in fifty-four females 31-36. Color olive above, light below. (Description based on one hundred and twelve specimens from Hainan.)

The above description agrees very well with that of a series of eighty specimens from Fukien. The three largest males in this Fukien series measure 358, 324 and 310, the three largest females 378, 361 and 340 mm., from snout to vent (Pope, 1929, p. 455).

In the adult male, the anterior head scales and plates are usually granular

or finely tuberculate, while the scales of the cloacal region more or less constantly bear a single tubercle apiece. These sexual characters are not so constant or conspicuous as the somewhat similar ones found in *chinensis*.

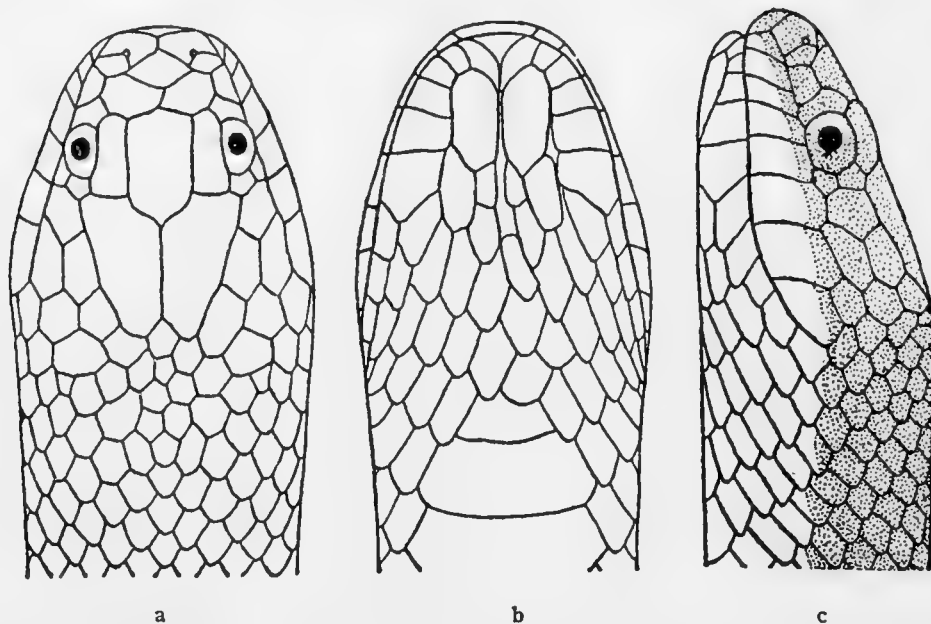


FIG. 63. *Enhydris plumbea*.  $\times 3$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. Specimen from Formosa. (From Maki.)

The hemipenis of *plumbea* differs from that of *chinensis* only in minor details (Hainan specimen examined).

*Distribution*.—*E. plumbea* is known from the following Chinese localities:

Chekiang: Wenchow.

Fukien: Chungan Hsien; Kienning; Yenping and vicinity; Foochow; Kuliang; Futsing Hsien; Amoy.

Kwangtung: northern boundary region; Chonglok; Wuyung; Canton; Lilong; Kowloon.

Hainan: Hoihow; Tingan; Nodoa.

Distributed from Mandalay in Burma, Tongking, and southeastern China, southward throughout the peninsula of southeastern Asia and into the Malay Archipelago. It has long been known on Formosa.

*Habits and Habitat*.—In Fukien and on Hainan I failed to detect any marked difference between the habitat preferences of *plumbea* and *chinensis* (Pope, 1929, p. 456). Mell (1922, p. 122) found *plumbea* up to an altitude of 700 meters in Kwangtung, or about the level to which it ascends in Fukien.

References to the habits of this species are few and brief: Wall (1903, p. 94) found it "in or about a sluggish stream," at Kowloon, while in Burma he



describes it as "an uncommon water snake occurring in lakes and rivers" (1925, p. 817); Flower (1899, p. 675) states that, in Siam and adjacent regions, it "usually frequents freshwater-ponds or rivulets," but has also been taken by him some distance from water.

In contrast to fish-eating *chinensis*, the present species prefers a diet of frogs as shown by Schmidt (1927, p. 449), Pope (1929, pp. 358 and 456) and five American Museum specimens from localities as indicated and not previously reported on, as follows:

No. 28053, containing remains of *Rana limnocharis* (Hainan).

No. 28102, containing remains of a species of *Microhyla* (Hainan).

Nos. 28041 and 28097, containing remains of unidentifiable frogs (Hainan).

No. 8832, containing remains of very small frogs (Siam).

In fact, the only evidence that *plumbea* has ever been known to eat fishes is the general statement by Maki (1931, p. 65) that it "feeds on fishes." No details are given, however.

Judging by Yenping and Hainan females, *plumbea* produces from 2 to 11 young, averaging about 6 (Schmidt, 1927, l.c., and Pope, 1929, p. 455). Maki (1931, l.c.), however, reports that on Formosa it "gives birth to 10-15 young in August." A Formosan specimen in the American Museum with only 7 eggs indicates that his estimate is high. A series of gravid females taken at Yenping in May (Pope, 1929, l.c.) stands in contradiction to Maki's statement in regard to the Formosan birth season. The great number of individuals (thirteen) measuring from 122 to 160 mm. in total length, and the absence of gravid females among the series of fifty-one specimens taken in Futsing Hsien the last week of August and later, show that the birth season there was entirely over late in August, 1925.

The eggs of the gravid females examined by me contain only small embryos, so I have not been able to decide at first hand whether *plumbea* is oviparous or ovoviviparous, but Maki, as quoted above, has settled this question. The condition in this species is, however, quite unlike that found in *chinensis* which is so obviously ovoviviparous.

The markedly fierce behavior of *plumbea* when on the defensive has been recorded by Flower (1899, l.c.) and Schmidt (1927, l.c.). While on guard, the body forms a single large loop and the neck is bent sharply like a crook. The strike is little more than a frantic jab. I have seen a specimen progress on a smooth floor by throwing its body forward so that the tail sometimes even fell in front of the head. This is most unusual behavior for a snake.

*Material examined*.—I have seen the following material from China: 81 specimens from Fukien, 112 from Hainan, and 1 from an indefinite locality, in the American Museum; 2 each from Amoy and Hainan, and 1 without more

definite locality than China, in the British Museum; 1 from Hainan, in the Museum of Comparative Zoölogy; 10 from Fukien, and 1 from Wenchow, in the U. S. National Museum.

Subfamily BOIGINÆ

KEY FOR IDENTIFICATION OF CHINESE GENERA

- I. One or more of the middle ungrooved maxillary teeth much enlarged
  - A. Scales oblique, middorsal row enlarged; pupil horizontal.. *Ahætulla*, p. 322
  - B. Scales not oblique, middorsal row not enlarged
    - 1. Anal entire; pupil vertically elliptic..... *Psammodynastes*, p. 324
    - 2. Anal divided; pupil round..... *Taphrometopon*, p. 320
- II. None of the middle ungrooved maxillary teeth enlarged
  - A. Pupil vertically elliptic; head very distinct from neck.... *Boiga*, p. 327
  - B. Pupil round; head moderately distinct from neck..... *Chrysopelea*, p. 318

*Boiga kræpelini* is a very aberrant species of its genus in lacking an enlarged middorsal scale row and in possessing a divided anal. The enlarged mid-dorsal scale row, frequently used in keys to separate *Boiga* from *Chrysopelea*, and the entire anal, hold good for *multomaculata*, a more representative species of *Boiga*. In *Chrysopelea* the anal is always divided.

Genus *Chrysopelea* Boie

In addition to the form treated below, this genus includes only two species, namely, *C. pelias* of the Malay Peninsula and Archipelago and *C. rhodopleuron* of the latter region.

OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Head and much of body black with numerous conspicuous, yellow cross-bands; ventrals with lateral keel and notch; habitus attenuate.

90. *Chrysopelea ornata* (Shaw)

Figure 64, d

*Coluber Ornatus* Shaw, 1802, Gen. Zool., III, p. 477.

*Chrysopelea ornata* Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 84 (record of Hongkong specimen seen in Hongkong City Hall Museum by von Moellendorff).—Wall, 1903, Proc. Zool. Soc. London, p. 94 (record of a specimen in Siccawei Museum and one in the Shanghai Museum but no locality given).—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 29 (Fukien).

*Description*.—Loreal sometimes absent; preoculars single; 2 postoculars; 2 anterior and 2 posterior temporals; 9 or 10 upper labials, 5th and 6th or 4th to 6th entering orbit; scales in 17 (rarely 15) rows, smooth or feebly keeled; ventrals 198-238, with strong lateral keels; subcaudals 106-139. (Description almost entirely abstracted from that of de Rooij, 1917, p. 212.)

The coloration is extremely variable, but a specimen from Along Bay is black above with numerous, narrow light bands across the middle of the back, while low on the sides each scale has one or two light spots. The upper lip is light and the head crossed by four narrow bands. It has 216 ventrals and 130 subcaudals.

There are no counts of Chinese material available.

Wall (1908, p. 227) records a Rangoon specimen 1360 mm. in total length, but this species may even exceed such dimensions.

Cope (1895, Pl. xxx, fig. 9) has figured the hemipenis. His illustration is reproduced here as Figure 64, d.

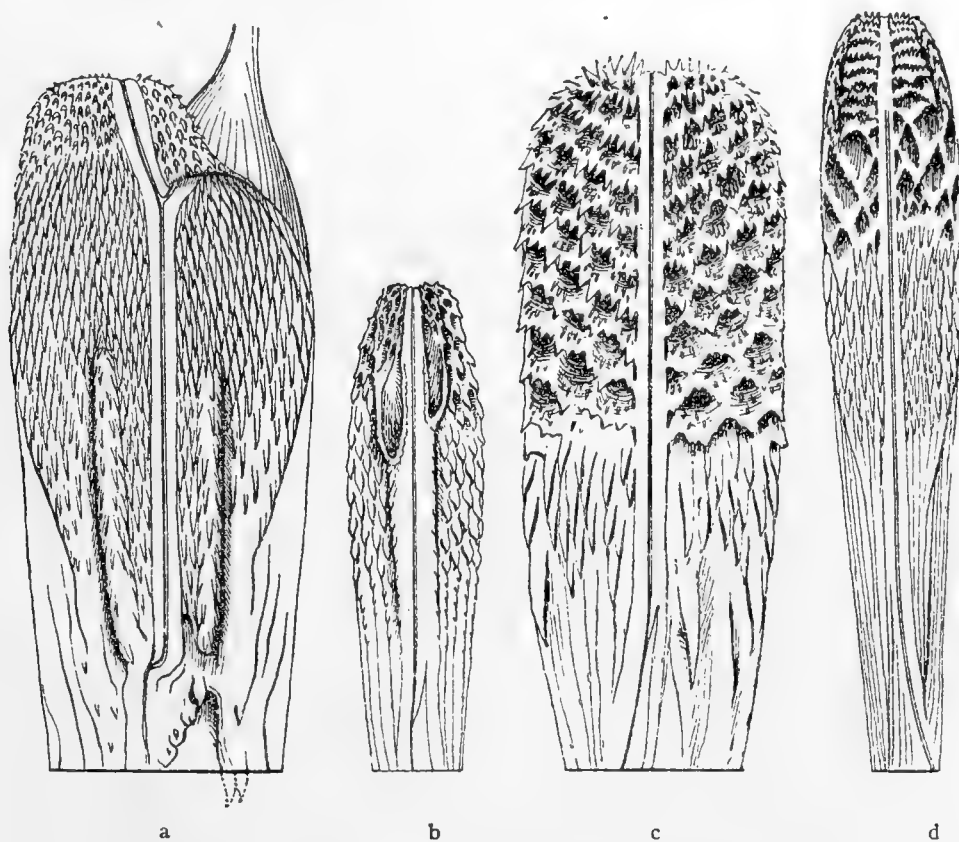


FIG. 64. a. Hemipenis of *Natrix piscator*. x 4. Specimen from India. (From Cope.)  
 b. Hemipenis of *Dendrophis boiga*. x 3. Specimen from India. (From Cope.)  
 c. Hemipenis of *Eurypholis major*. x 4. Specimen from China. (From Cope.)  
 d. Hemipenis of *Chrysopelea ornata*. x 2. Specimen from India. (From Cope.)

*Distribution*.—The acquisition by the American Museum of the specimen recently collected while swimming between islands in Along Bay, Tongking, establishes the occurrence of this snake in territory immediately adjacent to eastern China. There is, therefore, no longer any reason to doubt old Hong-

kong records, and *ornata* is to be expected on Hainan. Stanley (1914, p. 29) long ago recorded it from Fukien, where, however, it must be rare. Mell (1931, p. 213) failed to secure it in Kwangtung, while Fan (1931) does not list it from Kwangsi. Turning westward, one finds that Wall (1925, p. 819) has recorded material from Lashio, Burma, thus bringing the range of *ornata* fairly near the Yunnan border.

Distributed from eastern Bengal and the Eastern Himalayas southward throughout the peninsula of southeastern Asia into the Malay Archipelago (including the Philippines). It is also known from Ceylon and the Western Ghats of Peninsular India.

*Habits and Habitat*.—*C. ornata* is common in the plains of Burma but ascends at least 5000 feet in the "hills" (Wall, 1925, l.c.). It is arboreal but not entirely so, very vicious in disposition and diurnal in habits. The most interesting behavior credited to it is an ability to leap from an elevated position, flatten its body and glide in midair to a lower level. Such leaps have been repeatedly observed. Its food consists chiefly of geckos and other lizards, but birds, bats, mice, snakes and frogs are included in its diet. Frogs have been consistently refused by captive specimens, so they may not fall victim to *ornata* as a rule.

From 6 to 11 young are produced at a time but it is not known whether they are born alive. The young at least sometimes appear in June in the region of Rangoon.

The foregoing account of the habits of *ornata* has been abstracted chiefly from Wall's two detailed articles on this snake (1908, pp. 227-239, and 1921, pp. 305-315); also see Flower, 1899, p. 682; Wall, 1919, p. 574, 1925, l.c., 1926, p. 564; and Hediger, 1932, p. 239.

American Museum No. 2910 from Sumatra held a large lizard of the genus *Gekko* in its stomach.

This snake is only feebly poisonous and therefore not dangerous to man.

*Material examined*.—I have seen no specimen from China, but one recorded from Hongkong in the U. S. National Museum (No. 55876). The fact that Stejneger did not include this record in his 1925 paper indicates that he doubts its validity. A specimen in the American Museum from Along Bay, Tongking, has already been alluded to.

#### Genus *Taphrometopon* Brandt

This genus is monotypic.

#### OBVIOUS RECOGNITION CHARACTERS

A finely lineate pattern; scales without keels, in 17 rows at midbody; anal divided; habitus attenuate.

91. *Taphrometopon lineolatum* (Brandt)

## Plate XIV

*Coluber* (*Taphrometopon*) *lineolatus* Brandt, 1838, Bull. Acad. Imp. Sci. St. Pétersbourg, III, p. 243 (type locality, deserts near the Caspian Sea).

*Taphrometopon lineolatum* Peters, 1861, Proc. Zool. Soc. London, p. 47, figs. 1-5.—Bedriaga, 1912, Wiss. Res. Przewalski Cent.-Asien Reisen, Zool., III, Abt. 1, p. 704.

*Psammophis schokari* Mocquard, 1910, Bull. Mus. Hist. Nat., Paris, XVI, p. 151 (Kuche, Sinkiang; Sachow, Kansu) (not of Forskal, 1775).

*Description*.—Upper labials 9, 4th, 5th and 6th entering orbit; preoculars single; postoculars 2 or 3; anterior temporals 2; posterior temporals 2 or 3; scales without keels, in 17 rows on the neck and at midbody, 13 before the vent; ventrals 174-206; subcaudals 72-107; maximum length 770+280 mm. (Composite description.)

A brief description of three Chinese specimens in the U. S. National Museum is set forth in Table XLII.

TABLE XLII. VENTRAL, SUBCAUDAL AND SCALE ROW COUNTS OF *TAPHROMETOPON LINEOLATUM* FROM CHINA

<i>Locality</i>	<i>Sex</i>	<i>Scales</i>	<i>Ventrals</i>	<i>Subcaudals</i>	<i>U. S. Nat. Mus. No.</i>
near Ningsia . . . . .	♀	17-17-13	183	72 +	73186
35 miles northwest of Ningsia . . .		17-17-13	186	97(+?)	68477
35 miles northwest of Ningsia . . .		17-17-13	182	90	68478

A translation of the original description follows:

Head quite narrow, oblong-square. Neck a little thicker than a goose quill. Scales covering the middle of the back all quite narrowly lanceolate. Abdomen rather flat, white. Neck and anterior part of the abdomen sprinkled with olivaceous-blackish spots, smaller laterally and a little larger centrally. Forehead and middle of the crown and occiput gray shading into olive. Back gray, except for four lines shading from black to olive, two of which, starting parallel between the eyes but less distinctly in the middle of the back, extend as paler lines to the tail, and the other two are seen beginning behind the nostrils and interrupted by the eyes, fading somewhat and grayer on the sides of the body. Length of body 1' 11"; of tail 5½". Greatest width of abdomen 4".

*Distribution*.—*T. lineolatum* ranges from Baluchistan northwestward to the Caspian Sea and thence eastward into Mongolia, Kansu and Ningsia. It apparently reaches the limit of its penetration into China from the northwest in the region of the city of Ningsia and has long been known from the Alashan (Strauch, 1876, p. 51).

Zarevskij (1925, p. 86, and 1930, p. 215) gives locality records for Mongolia, while Nikolsky (1916, pp. 194-196) lists specimens from very numerous localities widely scattered over Asia.

*Habits and Habitat*.—This slender snake is essentially an inhabitant of the arid regions of western and central Asia.

Peters (1861, p. 50) records finding three lizards of the genera *Phrynocephalus* and *Eremias* in the stomach of a single individual.

*Material examined*.—I have seen the 3 specimens listed in the table.

*Remarks*.—Dr. Angel has kindly re-examined one of the two snakes from Kuche and Sachow recorded by Mocquard in 1910 (p. 151) as *Psammophis schokari*, and has identified it as *T. lineolatum*.

#### Genus *Ahaetulla* Link

*Ahaetulla* Link, 1807, Beschreib. Natural.-Samml. Rostock, pt. 2, p. 73 (type, *A. mycterizans* Link = *Coluber nasuta* Lacépède, designated by Meise and Hennig, 1932).—Stejneger, 1933, Copeia, (N.S.) No. 4, p. 201 (discussion), p. 203 (synonymy).

*Passerila* Gray, 1825, Ann. Phil., (N.S.) X, p. 208 (substitute name for *Dryinus* Merrem, 1820, preoccupied, type *D. mycterizans*).

This genus is composed of some ten species found from Ceylon, Peninsular India and the Eastern Himalayas to southern China and thence southward into the Malay Archipelago. One widely distributed species, *A. mycterizans*, readily recognized by its rostral appendage and green coloration, occurs near the borders of China in Burma (Anderson, 1879, p. 826; Boulenger, 1888, p. 600; and Wall, 1925, p. 819).

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Uniform green or olive brown above and below with a light line along either side of the ventrals, except on the neck which has a more or less well-developed pattern; head very large, snout wedge-shaped, loreal double; habitus excessively attenuate; scales oblique.

#### 92. *Ahaetulla prasina* (Boie)

Plate XIII, J, K, L, M, N and O

*Dryophis prasina* Boie, 1827, Isis, p. 545 (type locality, Java).

*Dryophis prasinus* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 123 (Lofaoshan, Kwangtung).

*Dryophis prasinus chinensis* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 323 (type locality, Yaoshan, Kwangsi).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 116 (Lohsiang, Chihnsiu and Kuchen, Kwangsi).

*Ahaetulla prasina* Stejneger, 1933, Copeia, (N.S.) No. 4, p. 201 (discussion), p. 203 (synonymy).

*Description*.—Two loreals; upper labials 9, 4th, 5th and 6th entering orbit; preoculars single; postoculars 2 and 3; anterior temporals 2; posterior temporals 3; scales smooth, in 15 rows at midbody; ventrals in twenty-three males 189-209, in fifteen females 191-202; subcaudals in twenty-three males 158-177, in fifteen females 154-168; length 764+420 mm. Color green above and below, a yellow line along each side of belly and 2 median lines on anterior half of body; interstitial skin of neck intermixed black and white. (This description of Yaoshan material is, except as otherwise indicated, based on a single female specimen.)

The oblique scales are reduced to 13 or 11 rows before the vent and are more or less keeled in the sacral region. Fan (1931, p. 117) does not mention this reduction and sacral keeling for his large Yaoshan series in part described above.

The male from Hokow in the Museum of Comparative Zoölogy has 201 ventrals and 174 subcaudals.

Mertens (1930, p. 316) gives interesting data on the number of ventrals and subcaudals in material from Bali, Lombok and Sumbawa. His data are not in entire agreement with those of Fan. Mertens (p. 317) also states that, in the sacral region, the scales of the males are much more heavily keeled than those of the females.

The hemipenis extends to the seventh subcaudal plate. It is spinous proximally, calyculate distally, the two rather indefinite areas thus formed merging one into the other. The edges of the calyces are scalloped, the scallops more or less spine-like. Near the base of the organ, six very large spines of about equal size are set together in a compact group. Numerous small, thick but compressed and recurved spines extend proximal and lateral to this group and separate it from the sulcus. Just distal to this same enlarged group there is a bare space bordered laterally by two spinous longitudinal ridges that converge just before the tip of the organ. The sulcus is not forked. (Description based on a specimen from Hokow, southeastern Yunnan.)

*Distribution*.—This snake has been taken in China only at the southeastern border of Yunnan (Hokow), in eastern Kwangsi (Yaoshan) and in Kwangtung (Lofaoshan). Wall (1925, p. 819) records a specimen from Huton, in the Kachin Hills, and quotes numerous other records for Burma. It is, therefore, to be expected in southwestern Yunnan.

Distributed from the Eastern Himalayas and Bengal southward throughout the peninsula of southeastern Asia into the Malay Archipelago to the Philippines (Palawan and adjacent islands).

*Habits and Habitat*.—Fan (1931, p. 118) states that *prasina* is common in dense woods or thickets of Yaoshan above an altitude of 800 feet, while Mell (1922, p. 123) secured it from 250 to 550 meters above sea-level in Kwangtung. Wall (1925, l.c.) considers it to be "a fairly common denizen of the plains throughout Burma, ascending hills to about 5000 feet elevation." Compare Mertens' notes, 1930, p. 318.

Wall (1910, p. 834) records finding a gecko in the stomach of a specimen, and Boulenger (1912, p. 175) states that it feeds chiefly on lizards and frogs. Mertens (1930, p. 319) believes that it prefers frogs but also consumes lizards.

A gravid *prasina* holding 7 eggs was secured on May 23 in Burma (Wall and Evans, 1901, p. 616); another with 9 eggs was killed on June 5 in the same

country (Evans, 1904, p. 169), while a third, found in Upper Assam during the end of March or in early April, held 3 eggs measuring 33.3 x 10.9 mm. (Wall, 1910, p. 834). No trace of embryos was visible in the eggs of the first and last lots. This species is probably oviparous.

Although mildly poisonous, this snake is not at all dangerous to man. Its bite, however, will kill *Lacerta muralis* in 15-20 minutes (Mertens, 1930, l.c.).

Mertens (1930, l.c.) describes it as diurnal.

When annoyed it inflates the neck vertically, at the same time drawing it into an S-shaped loop. This causes the interstitial colors to become visible suddenly (Mell, 1929, p. 256, and Pl. IV), and gives the snake a startling or frightening appearance. Evans (1904, l.c.) and Flower (1899, p. 682) describe its disposition as gentle.

*Material examined*:—I have seen only 2 specimens of *prasina* from China as follows: one from Hokow, southeastern Yunnan, and the other from Lohsiang, Kwangsi. Both of these are in the Museum of Comparative Zoölogy.

*Remarks*:—Mell (1930, p. 323, and 1931, p. 213) has called this snake from Kwangtung, Kwangsi and Tongking subspecies *chinensis* because specimens from these areas have fewer subcaudals and ventrals than typical *prasina* from the Malay Archipelago. The differences in counts as indicated by Mell are not great, so I have not followed him, but should further studies based on more than one character substantiate his belief that this species is divisible into good geographic subspecies, the name *chinensis* will be available for a Chinese form.

#### Genus *Psammodynastes* Guenther

*Psammodynastes* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 140 (type, *Psammophis pulverulenta*).

This genus includes only a single species in addition to *pulverulentus*, namely, *pictus* of the Malay Peninsula and Archipelago.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Females blackish brown, males grayish brown above and below, the brown in both sexes finely variegated with darker and lighter hues; head distinctly viper-like; scales smooth, in 17-15 rows; anal entire.

#### 93. *Psammodynastes pulverulentus* (Boie)

Plate XV, A, B and C

*Psammophis pulverulenta* Boie, 1827, Isis, p. 547 (type locality, Java).

*Psammodynastes pulverulentus* Barbour, 1912, Mem. Mus. Comp. Zool., XLIV, p. 127 (Wuchih Mts., Hainan).

—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 111 (Lohsiang, Chihnsiu and Kuchen, Kwangsi).

*Description*:—Three pairs of chin-shields; upper labials 8, very rarely 7; postoculars 2 or 3; anterior temporals 2, very rarely 3; posterior temporals 2,



occasionally 3; scales smooth, in 17 rows on the neck and at midbody, 15 before the vent; ventrals in seven males 150-159, in eleven females 157-166; subcaudals in six males 51-54, in eleven females 43-51; length of three largest females 421+84, 388+79 and 382+85, of three largest males 381+83+, 370+92 and 349+85 mm., respectively. Color purplish brown densely spotted with light gray, forming a very obscure pattern which is much more distinct in the young; females a great deal darker than males, sometimes almost black. (Description based on seven specimens from Yenping and eleven from Futsing Hsien.)

In 1929 (p. 464) I erroneously gave the ventral range of five of the eleven females recorded above as 153-165, the average as 163, but the actual range in these five is 157-165, the average 162.

The range of ventral and subcaudal counts of Chinese and Formosan material is shown by Table XLIII, in which the numerals in parentheses indicate the number of specimens counted.

TABLE XLIII. VENTRAL AND SUBCAUDAL COUNTS OF *PSAMMODYNASTES PULVERULENTUS* FROM CHINA AND FORMOSA

Locality	Sex	Ventrals	Subcaudals	Reference or Museum
Formosa.....	♂	(6)161-172	(6)62-79	Maki, 1931, p. 145
Formosa.....	♀	(6)170-177	(6)58-66	Maki, 1931, p. 145
southern Fukien.....	♂	153	49	British Museum
southern Fukien.....	♀	154	47	British Museum
Wuting.....	♀	168	48	British Museum
Yaoshan.....	♂	151	52	Mell, 1930, p. 323
Yaoshan.....	♂	(12)151-166	(12)49-60	Fan, 1931, p. 113
Yaoshan.....	♀	(9)154-165	(9)46-56	Fan, 1931, p. 113
Hainan.....	♂	(6)157-167	(6)61-70	Schmidt, 1927, p. 452
Hainan.....	♀	171	59	Schmidt, 1927, p. 452

Maki (1931, p. 145) gives the maximum total length of male and female, respectively, as 520 and 625 mm.

The hemipenis extends to the ninth to tenth subcaudal plates, and is forked opposite the sixth. It is entirely spinous, the spines being nearly uniform in size, with the exception of two large, thick basal spines or hooks set opposite each other on either side of the sulcus. Proximal to the point of

forking, the spines show no definite arrangement, but opposite and distal to that point they are set in oblique rows that join on a line opposite the sulcus to form V's whose apices are distal to their bases. The spines of each row are joined basally by soft tissue. The sulcus is divided some distance proximal to the point of forking and has fairly prominent, smooth lips which are almost entirely devoid of spines throughout. (Cope, in 1895, Pl. xxix, fig. 10, illustrated a Tongking example, but his figure does not show the true conditions clearly. The present description is based on a Fukien specimen.)

*Distribution*.—This species is known from the following localities in China:

Fukien: Yenping and vicinity; Futsing Hsien; northern and southern Fukien.

Yunnan: Wuting.

Kwangsi: Yaoshan.

Kwangtung: Shiuhing; Lofaoshan.

Hainan: Nodda; Wuchih Mts.

Distributed from the Eastern Himalayas and Assam southward throughout the peninsula of southeastern Asia and the Malay Archipelago. It is well known on Formosa, and its presence at Katha, Kutkai, etc. in Upper Burma and Wuting in Yunnan indicates that it is to be expected in extreme southwestern China.

*Habits and Habitat*.—This snake generally prefers mountain forests at moderate to high altitudes but is sometimes found in more open country. In Futsing Hsien, it occurs at low altitudes, a fact not surprising in view of the latitude of this locality. Mell (1922, p. 123) found it generally distributed in northern and southern Kwangtung but most abundant in the higher northern part.

It has been described as diurnal as well as nocturnal, but all observers agree that it is active and vicious and even able to progress by a sort of jumping gait. I have seen it climb with agility, an accomplishment also noticed by others. When annoyed it strikes repeatedly and sometimes holds its mouth partly open.

Its diet consists of frogs and lizards. Among the latter, skinks seem to be its choice, but it has also been known to eat lacertids and agamids.

The number of young produced at a time by this ovoviviparous snake ranges from 3 to 10 and averages 6. Gravid females with the ova large, but the embryos still minute, were taken at Yenping in May, while Wall secured a hatchling in June at Rangoon, a gravid specimen killed at Kutkai on October 8, and females with embryos in very advanced stages at Shillong in August. These data give some idea of its breeding season at different altitudes in various parts of its range.

So much has been written on this fascinating snake that in order to pre-

serve smoothness and continuity I have scarcely documented the above account of its habits, which was, however, drawn from the following sources: Wall, 1910, pp. 72-79; 1912, p. 686; 1925, p. 818, and 1926, p. 564; Taylor, 1922, p. 213; Schmidt, 1927, p. 452; Pope, 1929, p. 464; Mertens, 1930, p. 314. (Compare also Kopstein, 1932, p. 80.)

A Yenping specimen in the U. S. National Museum (No. 65394) contains 10 well-developed eggs.

*Material examined*.—I have seen the following specimens from China: 7 from Yenping, 11 from Futsing Hsien, and 7 from Hainan, in the American Museum; 2 from southern Fukien, and 1 from Wuting, in the British Museum; 1 from the Wuchih Mts., in the Museum of Comparative Zoölogy; and 1 from Yenping, in the U. S. National Museum.

*Remarks*.—The high ventral count of Formosan specimens really warrants their separation as a distinct subspecies.

For an excellent general account of *pulverulentus* with colored plate, figures and map, see Wall, 1910, pp. 72-79.

#### Genus *Boiga* Fitzinger

This genus is widely distributed in southern Asia, tropical Africa and the Malay Archipelago, while it even reaches New Guinea, Australia, and the Solomon Islands.

*B. hexagonotus*, though not recorded from China, approaches the Yunnan boundary in Burma (Boulenger, 1888, p. 601; Wall, 1925, p. 818, and 1926, p. 564), and the same may be said of *B. cynodon* (Wall, 1925, l.c.).

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Brown above with numerous large dark blotches which may be joined to form a zigzag line; head broad, distinct from neck; pupil vertical; scales smooth; habitus attenuate.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Temporals not differentiated, their place occupied by numerous small scales; vertebral scale row not enlarged; anal divided. . . . . *kræpelini*, p. 327
- II. Temporals well developed, one to three in anterior row; vertebral scale row enlarged; anal entire. . . . . *multomaculata*, p. 330

#### 94. *Boiga kræpelini* Stejneger

##### Figure 65

*Boiga kræpelini* Stejneger, 1902, Proc. Biol. Soc. Wash., XV, p. 16 (type locality, Kelung, Formosa).

*Dipsadomorphus kræpelini* Wall, 1903, Proc. Zool. Soc. London, p. 94 (Formosa).

*Boiga sinensis* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 4 (type locality, Fukien); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 539, fig. 20 (amplified description).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 457 (Futsing Hsien and Chungan Hsien, Fukien; Yuanshan Hsien, Kiangsi).

*Boiga kræpelini sinensis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 213.

*Description*.—Upper labials 9 or 10; preoculars 2, occasionally 3; postoculars 1 or 2, occasionally 3; temporals not noticeably differentiated, small; scales smooth, oblique, 25-23-21-19-17, sometimes reduced to 15 before the vent; ventrals in five males 230-243, in three females 230-235; subcaudals in five males 127-154, in three females 130-136. (Description based on three examples from Yaoshan, one from Kiangsi and four from Fukien, including the type of *sinensis*.)

Two female Sūchow examples have 230 and 239 ventrals and 128+ and 147 subcaudals, respectively.

Steindachner (1913, p. 344) has given excellent figures of the skull of this species.

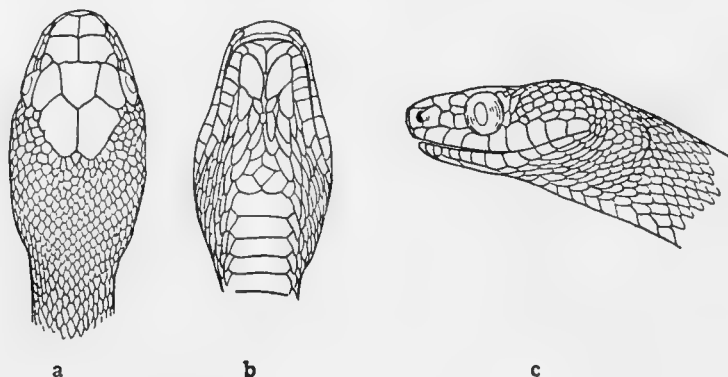


FIG. 65. *Boiga krapelini*. Nat. size. a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 23495 from Fukien.

The original description of the type specimen follows:

About 11 solid maxillary teeth, subequal, slightly separated from grooved fangs which are not much enlarged; head very distinct from neck; eye large, equaling its distance from anterior border of nostril, with vertically elliptical pupil; rostral wider than high, barely visible from above; internasals much broader than long, much shorter than prefrontals; frontal as long as broad, as long as its distance from rostral and as the interparietal suture; nasals large, posterior concave; loreal higher than long; 2 preoculars, the upper one reaching the upper surface of the head, but separated widely from frontal; 2 postoculars; temporals 4 + 5, scale-like, irregular; 9 supralabials of which the third, fourth and fifth enter the eye; 5 (on one side 6) lower labials in contact with anterior chin-shields which are much larger than the posterior pair; body compressed, about twice as high as wide; scales in 21 oblique rows, smooth, with apical pits, the vertebral row scarcely enlarged, the scales pointed behind; ventrals, 245, flat underneath, obtusely angulate laterally; anal double; subcaudals, 142 pairs. Color brownish gray, with about 57 darker cross-bars composed of blackedged scales from neck to anus, then cross-bars extending on the sides to about 4 scale rows from the ventrals; only faint indications of alternating lateral spots; top of head uniform brown; underside pale with a median area more grayish and laterally bordered by an irregular dusky line following the ventral angle.

The hemipenis extends to the twelfth subcaudal plate. It is spinous proxi-

mally and calyculate distally, the calyculate area being somewhat more extensive. Basally the spines are very small, but they increase rapidly in size toward the calyces into which they merge, the first few calyces bearing some spines on their otherwise scalloped edges. The calyces are well developed throughout, their scallops more or less calcified save at the tip of the organ; the sulcus is prominent, its lips bearing numerous spines of medium size in the spinous area but well-developed calyces in the calyculate area. (Description based on the type of *sinensis*.)

*Distribution*.—*B. kræpelini* is known only from Kwangsi (Yaoshan), Fukien (Chungan Hsien and Futsing Hsien), northeastern Kiangsi (Yuanshan Hsien), Szechwan (Süchow), and Formosa.

*Habits and Habitat*.—This snake apparently occurs at low as well as high altitudes in Fukien and Kwangsi (Pope, 1929, p. 457, and Fan, 1931, p. 109) but it probably inhabits country with a considerable number of trees or large bushes.

One specimen disgorged a bird, while another had itself been eaten by an *Elaphe carinata* (Pope, 1929, p. 458).

Maki (1931, p. 141) says: "This snake lays about 14 white eggs which are about 40 mm. in length, 17 mm. in width. It is arboreal and feeds on small birds and their eggs." Its arboreal habits probably account for its scarcity in collections.

I found it to be docile; only one of two specimens handled would bite and that one did not strike (Pope, 1929, l.c.).

*Material examined*.—I have seen the following Chinese material: 4 specimens from Fukien (including the type of *sinensis*), and 1 from Yuanshan Hsien, in the American Museum; and 2 from Süchow, in the U. S. National Museum (Nos. 69878 and 71579).

*Remarks*.—Before the Kwangsi and Szechwan records were available, it looked as though mainland *kræpelini* had fewer ventrals and subcaudals, but now, with counts from those two provinces nearly matching counts for Formosa, the matter is greatly complicated, i.e., apparently only Fukien and Kiangsi specimens have the low number of ventral and subcaudal plates. However, Fan (1931, p. 111) records only three Yaoshan specimens, and yet his subcaudal counts are 133, 141 and 154, the lowest coming within 3 plates of the low for Kiangsi-Fukien material, while the highest is only 4 below the high for Formosa as recorded by Maki (1931, p. 142). I have taken sex into consideration. These figures show that, when such high numbers and small series are involved, considerable normal variation must be expected. However, if a large series from Fukien and Kiangsi prove that *kræpelini* in these provinces actually does have constantly low average counts, the name *sinensis* may be applied to designate it as a subspecies.

This problem is of special interest because many Formosan species do skip Fukien and turn up again in Szechwan and Kwangsi, and obviously species common to all these provinces may be expected to vary somewhat.

Note the remark about *kræpelini* immediately following the key to the genera of Boiginae.

95. ***Boiga multomaculata*** (Boie)

Plate XV, D, E, F, G, H and I

*Dipsas multomaculata* Boie, 1827, Isis, p. 549 (type locality, Java).

*Dipsas multimaculata* Jan and Sordelli, 1871, Icon. Ophid., Livr. 38, Pl. III (Hongkong).

*Dipsadomorphus multimaculatus* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 123 (Namkong and Lofaoshan in Kwangtung; northern Kwangtung; and Hongkong Peak).

*Boiga multimaculata hainanensis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 213 (type locality, Hainan).

*Boiga multimaculata sikiangensis* Mell, 1931, l.c. (type locality, Kwangtung).

*Description*.—Upper labials 8, occasionally 9, rarely 7; preoculars 1, rarely 2; postoculars 2, rarely 3; anterior temporals 2, occasionally 1, rarely 3; posterior temporals 2 or 3, rarely 4; scales 19-17-15 or 19-17-15-13, smooth, the middorsal row enlarged; ventrals in twelve males 200-213, in eleven females 207-221; subcaudals in twelve males 82-98, in ten females 80-97; total length of largest male 836, largest female 834 mm. Grayish brown above with a double series of conspicuous, dark brown spots, each alternating with a series of much smaller ones lower on the sides. A bold spearhead-shaped blotch on the head and a narrow stripe through the eye. (Description based on twenty-three specimens from Nodda.)

Fan (1931, p. 109) gives the ventral and subcaudal ranges of six specimens from Yaoshan as 186-203 and 79-85, respectively, while I have recorded a Fukien male with 197 ventrals and 84 subcaudals. These data indicate that Fukien and Hainan *multomaculata* agree in their ventral counts fairly well but have a higher average than Kwangsi material. This question warrants further study.

The hemipenis extends to the twelfth subcaudal plate. It is spinous proximally and calyculate distally, the two areas thus characterized being about equal in extent. The spines are large and nearly uniform in size, a little better developed distally where they merge into the calyces, the first few of which have some large spines on their otherwise scalloped edges. The scallops are well developed throughout and more or less calcified save at the tip of the organ; the sulcus is prominent, its lips bearing only a few minute spines in the spinous area but well-developed calyces in the calyculate one. (Description based on a specimen from Nodda.)

*Distribution*.—This snake is recorded in China from eastern Kwangsi (Lohsiang); Kwangtung including Hainan; southern Kiangsi (Changning); and eastern Fukien (Futsing Hsien).

Distributed from eastern Bengal through Burma and the peninsula of southeastern Asia into the Malay Archipelago to Celebes and Borneo. It apparently is not found in the Malay Peninsula (Smith, 1930, p. 64).

*Habits and Habitat*.—I found *B. multomaculata* to be common in the relatively open but bush-grown country about Nodda at low altitudes, while Wall (1925, p. 818) reports it common "in the plains of Lower Burma, and the southern part of Upper Burma, ascending to an altitude of about 5000 feet." In Kwangtung and on Hongkong, Mell (1922, p. 123) found it in sparsely wooded hilly country from 100 to 500 meters above sea-level.

Five Hainan specimens were found to have eaten birds and one a lizard, *Calotes versicolor* (Schmidt, 1927, p. 451), while the tail of a *C. versicolor* was dissected from another Chinese example (American Museum No. 27846). Wall (1925, p. 818, and 1926, p. 564) gives two records of this snake having eaten *Calotes* in Burma. The data on feeding strongly suggest arboreal habits, a point on which direct observations are much needed.

The following data confirm Wall's (1901, p. 534) evidence that *multomaculata* is oviparous: one Hainan female contains 5 well-developed eggs with embryos in very early stages of development, while another holds 6 eggs; Wall (1926, l.c.) records a Burmese female killed August 21 carrying 7 eggs nearly ready to be laid and another one, also from Burma, with the same number (1925, l.c.). His 1901 (l.c.) account of a Rangoon specimen depositing eggs on April 19 is puzzling. The most advanced eggs in the Hainan females measure 28 x 8 and 29 x 9 mm., respectively.

I described the characteristic defensive behavior of this species, already observed by Wall (1901, l.c.), as follows (Schmidt, 1927, p. 451):

When annoyed, the Blotched Snake assumes a defensive posture with the anterior part of the body thrown into several symmetrical S-shaped loops, with the neck strongly compressed and the head expanded at the rear. The tip of the tail may be strongly vibrated, producing a distinct noise among dry leaves. It strikes viciously and in a very business-like manner. The range of the stroke in a twenty-eight inch specimen was about twelve inches.

*Material examined*.—I have seen the following Chinese specimens: 23 from Hainan, and 1 from Fukien, in the American Museum; 1 from Hainan, in the British Museum; and 1 from Hainan, in the Museum of Comparative Zoölogy.

*Remarks*.—For additional references to the distribution and behavior of this snake see Mell, 1929, p. 10, etc.

#### Family ELAPIDÆ

##### KEY FOR IDENTIFICATION OF CHINESE GENERA

- |   |                          |
|---|--------------------------|
| I. Middorsal scale row enlarged; subcaudals undivided. . . . .              | <i>Bungarus</i> , p. 332 |
| II. Middorsal scale row not enlarged; all or most of the subcaudals divided |                          |

- A. Neck dilatable, surrounded by more scale rows than mid-body; internasal bordering nostril..... *Naja*, p. 346
- B. Neck not dilatable, not surrounded by more scale rows than midbody; internasal not bordering nostril
1. Fangs followed by one or more small teeth; scales in 15 rows throughout..... *Hemibungarus*, p. 344
  2. Fangs not followed by small teeth; scales in 13 rows throughout..... *Calliophis*, p. 340

The number of scale rows will not always distinguish *Hemibungarus* from *Calliophis* since several extra-Chinese species of the former have only 13.

#### Genus *Bungarus* Daudin

The species of this genus are distributed from Baluchistan eastward through India and Burma to southern China, thence southward through the peninsula of southeastern Asia into the Malay Archipelago.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Dorsum with alternate black and yellow or black and white bands; loreal absent; scales smooth, vertebral row enlarged; subcaudals undivided.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Pattern of black and yellow bands, all of which completely encircle the body; tail blunt..... *fasciatus*, p. 332
- II. Pattern of black and white bands, the former interrupted on the belly; tail tapering to a point..... *multicinctus*, p. 335

#### 96. *Bungarus fasciatus* (Schneider)

Plate XV, J, K and L

*Pseudoboa Fasciata* Schneider, 1801, Hist. Amphib., II, p. 283.

*Bungarus annularis* Duméril and Bibron, 1854, Erp. Gén., VII, p. 1269 (China).

*Bungarus fasciatus* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 220 (China).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 118 (Lohsiang, Kwangsi).

*Bungarus fasciatus bifasciatus* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 325 (type locality, Yaoshan, Kwangsi).

*Description*.—Loreal absent; upper labials 7, 3rd and 4th entering orbit; preoculars single; postoculars 2; anterior temporals single; posterior temporals 2; scales smooth, in 15 rows throughout, middorsal row enlarged; ventrals in six males 212-222, in one female 216; subcaudals undivided, in five males 33-36, in one female 34. Color, banded with complete black and yellow annuli, the former a little wider and numbering 23-28+3-5. (Description based on Lohsiang material.)

This snake commonly grows to a length of 1500 mm., but 1800 mm. and even larger specimens are on record (Wall, 1911, p. 935, and Smith, 1911, p.



284). The Hokow male in the Museum of Comparative Zoölogy (No. 16733) measures 1350 mm. in total length, 140 mm. of which are occupied by the tail. It has 224 ventrals, 38 subcaudals and 21 + 3 light bands, no one of which is split or shows any other irregularity.

The hemipenis extends to the seventh subcaudal plate and is spinous proximally, calyculate distally, the two areas thus characterized being about equal in extent. The spines are at first small but gradually increase in size until, finally, those adjacent to the calyces become suddenly enlarged. The line of demarcation between the spines and calyces is abrupt, the first calyces being raised as a flounce or ridge. The remaining ones are smaller and relatively uniform. The organ is barely forked at the tip. About five indistinct, longitudinal ridges are present in the calyculate region. The lips of the sulcus are prominent throughout, set with small, uniform spines in the spinous area, and calyces in the calyculate region. (Description based on a specimen from Canton.)

Although the sulcus obviously forks, I can detect no forking of the entire organ in the Hokow specimen, No. 16733.

*Distribution*.—*B. fasciatus* has been recorded from the following localities in China:

Fukien: (no specific locality).

Kwangtung: Tinghushan; Canton and region; Wuyung; Namkong; Lofaoshan; Fumun; Lilong; mainland opposite Hongkong.

Kwangsi: Lohsiang.

Yunnan: Kutung; Hokow.

It has not been found on Hainan. Guenther's (1862, p. 391) record for Peiping is obviously an error.

Distributed from northeastern Peninsular India eastward across Burma, into southern China, and southward through the peninsula of southeastern Asia into the East Indies.

*Habits and Habitat*.—*B. fasciatus* has been recorded only from low altitudes in southern China, but, in western Yunnan, it ascends to 5500 feet at Kutung (Annandale, 1911, p. 218). Wall (1925, p. 819) describes it in Burma as "a common species in the plains, ascending the hills to about 5300 feet." Mell (1922, p. 124) found it common in southern Kwangtung, while Fan (1931, p. 118) records a good series from Yaoshan, Kwangsi.

Wall (1911, pp. 933-948) has written an excellent general account of this krait, the salient points of which may be briefly summarized as follows:

1. *B. fasciatus* prefers relatively open country to jungles, and is frequently seen about the habitations of man. It is often found in damp situations such as flooded fields, river banks and the borders of pools (pp. 935-936).

2. Its disposition is exceedingly lethargic, nor does it ever assume a defensive pose from which to strike. Persistent teasing sometimes will not induce it to bite (pp. 936-937).
3. It is decidedly nocturnal but occasionally may be found feeding by day (p. 938).
4. It is most abundant during the Indian rainy season (p. 938).
5. Its food consists chiefly of snakes, both large and small, but there is evidence that it will also eat lizards, fish, and even snake eggs (pp. 938-940).

A Kwangtung female kept in captivity by Mell (1922, l.c.) laid, on May 29, eleven eggs measuring 45-54 x 22-24 mm. The following note by Evans (1905, p. 519) sheds considerable light on the breeding of *fasciatus* in the region of Rangoon:

The following note may prove of interest. On the 17th of May I received a letter from Mr. J. D. Hamilton, I. F. S., in which he mentioned that on the day previous, while digging up some elephant tusks, he came on a Krait (*Bungarus fasciatus*) with eight eggs and four young. The female had sloughed before going underground and when found was in poor condition.

During the afternoon of the 17th he kindly sent me the female with two hatchlings, also the egg shells of which there were eight in three lots—five in a cluster, two cemented together, and one single.

The 'Krait' though possessing a nice clean skin was distinctly thin. On being touched about the body she promptly flattened herself in an extraordinary manner, and on being irritated hissed, but made no attempt to strike. She shewed no concern whatever about the youngsters, however much they were molested. The snake was very sluggish.

#### MEASUREMENTS

Length 3' 11½" [1206 mm.]

Tail 4" [102 mm.]

Unlike the mother the youngsters were particularly active. They were extremely intolerant of the sun: an exposure of a minute or two caused them to seek the shade.

With regard to their markings, they resemble that of the adult except that they are very much paler. The prune purple bands are more of a leaden hue, and the canary yellow bands a faint dirty white not at all approaching yellow. The markings, however, were so defined as to render this snake unmistakable at first sight even at a very early age.

The end of the tail in adults is, as a rule, blunted, but in both these young specimens it was more pointed.

The hatchlings measured:

(1) Length 12½"—Tail 1¼" [= 349 mm. total length]

(2) Length 11¾"—Tail 1⅛" [= 327 mm. total length]

There was nothing unusual about them. The egg shells were soaked in water and when softened indentations were removed and the shells filled with water. Owing to the position of apertures of exit, only three could be measured with anything approaching to accuracy. The average measurements taken were 2.375" x 1.5" [60.3 x 38.1 mm.]. The eggs struck me as being of large size considering the snake measured just on 4'.

Mell (1929) has discussed various aspects of the behavior of *fasciatus*, while Smith (1915, p. 177) describes its actions in captivity as follows:

Instead of endeavouring to escape, it throws its body into a loose coil or two, and hides

its head away beneath some part of it. . . . If provoked with a stick it will give a convulsive jerk or two, and hide its head again beneath some other part of the body. If left undisturbed, it will remain in this position for a long time.

*Material examined*.—I have seen the following specimens from China: 1 from Hokow, in the Museum of Comparative Zoölogy; and 1 from Canton, in the Senckenbergisches Museum, Frankfort.

*Remarks*.—Man is rarely killed by this poisonous but extremely docile snake. Its bite has been known, however, to cause death within 15 hours (Wall, 1928, pp. 99 and 101).

97. *Bungarus multicinctus multicinctus* Blyth

Figure 66

- Bungarus semifasciatus* Guenther, 1858, Cat. Colubr. Snakes Brit. Mus., p. 221 (part: China); 1864, Rept. Brit. India, p. 344 (China and Formosa) (not of Boie, 1827); 1888, Ann. Mag. Nat. Hist., (6) I, p. 171 (Lushan, Kiangsi) (not of Boie, 1827).—Boettger, 1885, Ber. Offenbach. Ver. Naturk., XXIV-XXV, p. 128 (Canton region) (not of Boie, 1827).
- Bungarus multicinctus* Blyth, 1861, Journ. Asiat. Soc. Bengal, XXIX, p. 98 (type locality, Amoy).
- Bungarus coeruleus* Steindachner, 1869, Reise Novara, Zool., I, Rept., p. 84 (China) (erroneous spelling of *caruleus*; not of Daudin, 1803).
- Bungarus semifasciatus* David, 1873, Journ. N.-China Br. Roy. Asiat. Soc., VII, p. 228 (Kiangsi) (erroneous spelling of *Bungarus*).
- Bungarus candidus* var. *multicinctus* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 369 (part: China; Lushan, Kiangsi; Hoihow, Hainan; Formosa).
- Bungarus candidus multicinctus* Boettger, 1898, Kat. Rept. Mus. Senckenberg, II, p. 119.
- Bungarus candidus* var. *semifasciatus* Werner, 1904, Abh. Bayer. Akad. Wiss., II Kl., XXII, p. 357 (China) (not of Boie, 1827).
- Bungarus caeruleus multicinctus* Barbour, 1912, Mem. Mus. Comp. Zool., XL, p. 131 (Ichang, Hupeh).
- Bungarus candidus* Maxwell, 1912, China Med. Journ., p. 243 (Fukien) (not of Linnæus, 1758).—Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 30 (Chekiang and Fukien) (not of Linnæus, 1758); 1916, XLVII, p. xiv (Hoihow, Hainan; Ningteh, Fukien) (not of Linnæus, 1758); 1917, XLVIII, p. xii (Hoihow, Hainan) (not of Linnæus, 1758).
- Bungarus multicinctus* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 325 (Yaoshan, Kwangsi).
- Bungarus multicinctus multicinctus* Mell, 1931, Lingnan Sci. Journ., VIII, p. 214.

*Description*.—Loreal absent; upper labials 7, rarely 6; preoculars single; postoculars 2; anterior temporals 1, very rarely 2; posterior temporals 2; scales smooth, in 15 rows throughout; ventrals in five males 206-211, in seven females 200-211; subcaudals undivided, in five males 45-51, in seven females 41-48. Color, black with 35-45 narrow, white bands on the body and 9-16 on the tail; length from snout to vent in males 960, 920, 325, 231 and ? mm., females 825, 720, 640, 433, 352, 269 and 229 mm. (Description based on twelve specimens from Fukien.)

Table XLIV records additional data for material from various parts of China. The figures in parentheses indicate the number of specimens involved.

In addition, Boettger (1885, p. 128) records six specimens from the Canton region with 34-41 + 11-15 light bands, 209-218 ventrals and 45-50 subcaudals, while Maki (1931, p. 154) gives the corresponding figures for Formosan ma-

TABLE XLIV. VENTRAL, SUBCAUDAL AND DORSAL CROSS-BAND COUNTS OF *BUNGARUS MULTICINCTUS MULTICINCTUS* FROM CHINA

Locality	Ventrals		Subcaudals		Light Bands on Body and Tail	Museum or Reference
	♂	♀	♂	♀		
Hainan.....	(1)211	(6)207-214	(1)48	(6)47-53	(7)32-40 + 9-15	Schmidt, 1927, p. 456
Yaoshan.....	(5)209-219	(2)211-216	(5)42-50	(2)42-48	(9)31-38 + 8-12	Fan, 1931, p. 122
Yochow, Shenchow and Changsha...	(3)205-210	(2)208-212	(3)48-51	(2)33-42	(5)34-40 + 9-17	Amer. Mus.
Ichang.....		(1)209		(1)44	(1)43 + 13	Mus. Comp. Zool.
southwestern Hunan.....	(2)209-211		(2)46-48		(2)41-35 + 13-12	U. S. Nat. Mus.

terial as 38-50 + 10-16, 204-218 and 40-51, his ventral and subcaudal counts being based on no less than thirty-one examples.

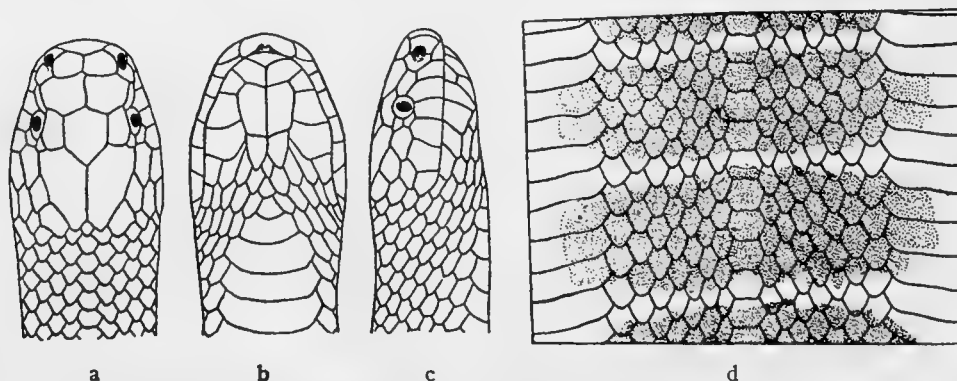


FIG. 66. *Bungarus multicinctus multicinctus*. a. Dorsal view of head, nat. size. b. Ventral view of head, nat. size. c. Lateral view of head, nat. size. d. Pattern of body,  $\times \frac{2}{3}$ . Specimen from Formosa. (From Maki.)

The hemipenis extends to the ninth subcaudal plate and is slightly forked at the tip. It is spinous proximally, calyculate distally, the calyces covering a considerably more extensive area than the large spines. Proximal to the large spines, the organ is beset with numerous minute ones. The line of demarcation between spines and calyces is abrupt, but it does not extend straight across the organ, the calyces nearest the sulcus intruding somewhat on the spinous region. The large spines are uniformly thick, papilla-like in shape and blunt, except that each in turn is surmounted by a minute, sharp, spine-like point. The spines

adjacent to the calyces are nearly twice as large as the most proximal ones. The calyces are well developed and uniform save for a gradual reduction in size toward the end of the organ. Their edges are deeply scalloped, the scallops papilla-like in shape and quite stiff. This stiffness gradually disappears toward the end of the organ. The sulcus is forked just distal to an imaginary line connecting the most distal of the large spines. It is inconspicuous throughout, its lips bearing calyces in the calyculate area and small spines throughout the spinous region. (Description based on a specimen from Changsha.)

The single penial character that separates *multicinctus*, on the one hand, from *candidus* and *ceruleus*, on the other, is the peculiar papilla-like shape and bluntness of the large spines of *multicinctus*.

*Distribution*.—The typical form of *multicinctus* is universally distributed in southeastern China. Its known range may be outlined by the following localities where it has been collected: an unknown locality in Chekiang; Lushan in Kiangsi; Yochow in Hunan; Ichang in Hupeh; Shenchow, Hunan, and an unnamed place in the southwestern part of the same province; and Yaoshan in Kwangsi. It is well known on both Hainan and Formosa.

The recorded facts indicate that the typical form is separated from *wang-haotingi* by the Yunnan plateau (on which no species of *Bungarus* has been collected) and the region to the southeast forming the boundary between China and Tongking. The two forms probably merge in the latter region. Although no specimens of either form have been collected in Kweichow and western Kwangsi we may expect the typical form to occur there.

*Habits and Habitat*.—This krait is generally distributed in southeastern China, apparently frequenting nearly all types of country. In northern Kwangtung, it ascends to 700 meters (Mell, 1922, p. 124), but, in spite of Boulenger's (1899, p. 165) Kuatun record, I believe that it does not actually enter the high mountains about Kuatun (Pope, 1929, p. 468). Its universal distribution in Kwangtung is attested by Mell (1922, l.c.), while Mell, Swinhoe (1863, p. 225), Pope (1929, l.c.) and Maki (1931, p. 154) have reported its frequent presence in or about human habitations. Both Maki (1931, l.c.) and Mell (1922, l.c.) speak of its fondness for the vicinity of water.

Maki (1931, l.c.) makes the general statement that this form feeds on "mice, snakes, frogs and fishes," and Swinhoe (1863, l.c.) writes that it eats rats. Examination of a large series of stomachs in the American Museum resulted only in the discovery of snake remains in a Shenchow individual and a partly digested *Amblycephalus moellendorffi* in a Hainan *multicinctus*. I believe that the general statements of Maki and Swinhoe require confirmation, at least for determination of how often other than ophidian food is consumed. Kraits are well known to be largely ophiophagous.

Little is known about the breeding of typical *multicinctus*, but Maki (1931, l.c.) describes it as oviparous without giving details; Mell (1922, l.c.) records finding a 262 mm. example in Kwangtung on July 21, and I collected two juveniles measuring 261 and 309 mm. in total length between August 25 and October 5 in Futsing Hsien.

I handled five *multicinctus* taken in the vicinity of Nodua and noted the following points in their behavior when teased during the daylight:

1. No individual attempted to strike after the usual manner of snakes.
2. Two of the five could not be induced to bite under any circumstances, while one only bit objects presented to it when held by the neck, and the other two bit each other repeatedly. One of this pair studied together finally flew into a fit of rage and bit anything brought near it. Some tendency to hold on was noticed in all the biting individuals.
3. All of the kraits threw themselves into irregular coils, jerked about vigorously and hid the head under the coils.
4. Two individuals made sudden dashes for freedom, two flattened the body, one violently threw its tail and the posterior part of its body about, while at least one hissed.

It is worthy of note that one of the five whose behavior is described above was surprised at night just behind a house in the Mission compound but made no effort to escape when the light was flashed on it (Schmidt, 1927, p. 456). This indicates that *multicinctus*, like *fasciatus* (Wall, 1911, p. 938) and *candidus* (Wall, 1908, p. 729), is nocturnal.

*Material examined*.—I have seen the following Chinese material: 7 specimens from Futsing Hsien, 3 from Foochow, 2 from Yenping, 1 from Shaowu, 1 from Yochow, 2 from Changsha, 2 from Shenchow and 7 from Hainan, in the American Museum; 1 each from Lushan, Tungyung Island off the coast of Fukien, Kuatun, and Hoihow, and 2 from an unknown locality, in the British Museum; 4 from the Canton region, in the Senckenbergisches Museum, Frankfurt; 1 from Ichang, in the Museum of Comparative Zoölogy; 1 from Foochow and 4 from southwestern Hunan, in the U. S. National Museum.

*Remarks*.—In an effort to thoroughly understand the relationships and distribution of *wanghaotingi*, I was forced to study *candidus* and *cæruleus* as well as *multicinctus* and have arrived at a conclusion similar to that reached by Barbour (1912, p. 134), namely, that *multicinctus*, *candidus*, and *cæruleus* are distinct species. I have compared the hemipenis of *multicinctus* with that of *cæruleus* from Ambala, India (Mus. Comp. Zool. No. 3213) and *candidus* from Batavia, Java (Mus. Comp. Zool. No. 3209) and found that, judging by the structure of this organ, *cæruleus* and *candidus* are closely allied but specifically distinct, while *multicinctus* occupies a relatively isolated position in the trio. Cope (1895, Pl. xxxi) has figured the hemipenis of *cæruleus*.

Dr. Prashad has kindly written me (July 15, 1933) from the Indian Mu-

seum that the type of *multicinctus* no longer exists. The type locality is Amoy, and not Formosa as stated by Stejneger in 1907, p. 397.

*B. multicinctus* from China was long recorded as *semifasciatus* whose type, locality is Java. I have not included all such references in the synonymy above.

Wall (1908, Pl. VIII, facing p. 720) has given a good colored illustration of *multicinctus*.

98. *Bungarus multicinctus wanghaotingi* Pope

*Bungarus multicinctus* Wall, 1925, Journ. Bombay Nat. Hist. Soc., XXX, p. 819 (Namkham, Burma) (not of Blyth, 1861); 1926, XXXI, p. 564 (Fort Hertz and Ani Sakan, Burma) (not of Blyth, 1861).

*Bungarus wanghaotingi* Pope, 1928, Amer. Mus. Novitates, No. 325, p. 3 (type locality, Yuankiang, Yunnan); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 469 (amplified description of type and description of paratype).

*Description*.—The original description of the type, an immature female, follows:

Rostral much broader than high, touching 6 scales, its suture with first upper labial about one-fifth as long as that with nasal; internasals two-thirds as long as prefrontals, which in turn are three-fourths as long as frontal; frontal slightly shorter than its distance from tip of snout, just as wide as parietals, which are as long as their distance from rostral; a single scale between nasal and eye. Seven upper labials, third and fourth entering orbit; 2 postoculars, upper twice as large as lower; one temporal; 7 lower labials, first 4 in contact with anterior chin-shields, fourth much the largest; posterior pair of chin-shields shorter than anterior. Scales in 15 rows throughout. Ventrals 228; subcaudals 53. Total length 484 mm., 0.13 occupied by tail; anal and subcaudals entire.

The black ground-color is crossed by 23 white bands on the body, 11 on the tail. These white bands cover 3 mid-dorsal scales on the neck where they are 16 scale-lengths apart, while posteriorly they are only half as wide and 4 scale-lengths apart. All of them expand before joining the uniform white of the belly, and near the center of each, at its juncture with the belly, there is a small, dark spot. Many of the white bands have a few black-centered scales. The black of the ground-color barely encroaches on the tips of the ventrals. Above the upper labials, the top and sides of the head are black. On either side of the neck, just back of the parietals, the scales are dimly white-tipped.

The single paratype, also an immature female, comes from the type locality and agrees closely with the type in coloration. It has 225 ventrals, 47 subcaudals, and 22 + 10 white bands. The head is imperfect.

Additional specimens of *wanghaotingi* are listed in Table XLV.

The first three localities given in the table are in Burma, the fourth in Tongking. Wall (1926, p. 564) records three additional Burmese (Fort Hertz and Ani Sakan near Maymyo) specimens 1040, 1028, and 1015 mm. long, one with 20 + 7, another 31 + 10 white bands. The specimen with 20 + 7 bands is the individual listed as from "Maymyo, 3000 feet" in the table.

*Distribution*.—This form of *multicinctus* is known in China only from its type locality, in Yunnan.

Distributed in eastern Burma from the region of Rangoon in the south, to

TABLE XLV. VENTRAL, SUBCAUDAL AND DORSAL CROSS BAND COUNTS OF *BUNGARUS MULTICINCTUS WANGHAOTINGI* FROM BURMA AND TONGKING

Locality	Sex	Ventrals	Subcaudals	Light Bands	Material or Reference
Toungoo.....	♂	213	50	31 + 11	Boulenger, 1896, p. 369 (seen)
Maymyo, 3000 feet	♂	228	54(+?)	20 + 7	Specimen in British Museum (seen)
Namkham.....	♀	219	55	?	Total length 790, tail 130 mm. Wall, 1925, p. 819
Manson Mts.....	♂	223	?	24 + 7+	Specimen in British Museum (seen)

Fort Hertz in the north, thence eastward across southern Yunnan as far as the Manson Mountains of northern Tongking. It is highly probable that Mocquard's (1905, p. 322) Caobang (Tongking) record of *candidus* as well as Angel's (1929, p. 80) listing of *cæruleus* from Laos are based on specimens of *wanghaotingi*.

*Habits and Habitat*.—Wall (1925, p. 820) describes the present subspecies as "a distinctly uncommon snake in Burma, confined to the plains." Nevertheless, it occurs in Burma at 3000 feet (Wall, 1926, l.c.), and the Tongking records indicate that it inhabits mountains there. The altitude of the type locality is 1500 feet.

Wall (1926, l.c.) found a mammal in the stomach of one individual.

A female 790 mm. in total length contained four large eggs measuring 31 x 7 mm. It was secured April 3 in the Northern Shan States (Namkham) (Wall, 1925, p. 819).

*Material examined*.—In addition to the type and paratype, I have examined only the 3 specimens marked "seen" in Table XLV. All of the 3 thus designated are preserved in the British Museum.

*Remarks*.—I believe there can be little doubt that the relationship of *wanghaotingi* is with *multicinctus* rather than with *cæruleus*. This belief is, at present, based on a careful study of color patterns. It would be interesting to go still further and settle the matter by making a comparison of hemipenes. Unfortunately, no male specimen of *wanghaotingi* is available.

#### Genus *Calliophis* Gray

The four known species of this genus in addition to *maccllellandi* inhabit



Ceylon, Peninsular India, Burma, the southern part of the peninsula of south-eastern Asia, and Sumatra.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Head black above with a broad, yellowish band crossing it just behind the eyes, and a little white on the snout; belly boldly blotched with black; scales smooth, in 13 rows throughout.

#### 99. *Calliophis maclellandi* (Reinhardt)

Plate XVI, F and G

*Elaps Maclellandi* Reinhardt, 1844, Calcutta Journ. Nat. Hist., IV, p. 532 (type locality, Assam).

*Callophis maclellandi* Guenther, 1864, Rept. Brit. India, p. 349 (Nepal, Darjeeling and Assam).

*Callophis annularis* Guenther, 1864, Rept. Brit. India, p. 350, Pl. xxiv (type locality given as "India" but corrected to South China by Boulenger, 1896, p. 399); 1888, Ann. Mag. Nat. Hist., (6) I, p. 171 (Lushan, Kiangsi).

*Callophis maclellandi* Slater, 1891, List Snakes Ind. Mus., p. 56 (Hongkong).

*Calliophis maclellandii* Stejneger, 1907, Herp. Japan, 1907, p. 391, figs. 323-324 (part).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 126 (Lohsiang, Kwangsi).

*Description*.—Loreal absent; upper labials 7, 3rd and 4th entering orbit; preoculars single; postoculars 2; anterior temporals single; posterior temporals 1 or 2; scales smooth, in 13 rows throughout; ventrals in males 201-203, female 213; subcaudals in males 32-33, female 28; dorsal cross-bands 28-31 + 4-6; total length of males 594 + 70 and 216 + 23, female 545 + 50. (Description based on three specimens from Chungan Hsien.)

The five Hainan examples recorded by Schmidt (1927, p. 456) have ventral and subcaudal counts as follows: 216, 38; 212, 36; 211, 38; 207, 36, and 205, 36. All are male, his statement notwithstanding, and in none do the dorsal bars (or spots) even approach the ventral blotches. This marked reduction in pattern is described in detail by him on page 457. Two male Tongking specimens in the British Museum stand in strong contrast to this Hainan series, for in both nearly all the dorsal bands are continued unbroken entirely around the body. The example from Bac-Kan has 218 ventrals, 26 subcaudals and 27 + 3 bands, while these counts in the one from Caobang are 225, 33 and 28 + 4, respectively.

The maximum length attained by *maclellandi* is 813 mm. (Wall, 1918, p. 630).

The original description, based upon the type specimen, follows:

This new species is of rather slender form; the short head, the broad, rounded and obtuse muzzle, as well as small eyes, resemble *Elaps lemniscatus*. The nostrils are large and situated between the 2 nasal plates, or perhaps rather behind the first. In the upper jaw, as far as I could discover after a strict examination, no solid teeth are to be found behind the venomous fangs. Among the plates of the head, the occipital plates are distinguished by their size and oblong form; two temporal plates, lying one behind the other, separate them from the labial plates, which are 7 at each side, of these the third and fourth border the eye. There

are two back plates and one ocular. The inferior labial plates are 6 in number at each side; they increase to the fourth, which is the largest of them all.

The body is of the normal form of the genus; it is covered with simple rhomboidal scales. The number of the rows of scales amount to 13, and in that respect our new serpent differs from the generality of the species of the genus, (in which the number of the rows of scales amount to fifteen), and agrees with a few species, forming with them a separate little group to which it bears no further resemblance either in colour or physionomy. The abdominal plates are rather broad and in number 216. The tail is thick, moderately pointed and short, or about one-tenth of the entire length, underneath it is covered with 27 pairs of subcaudal plates. At the root of the tail, the number of the rows of scales amount to 9.

With respect to the system of coloration, it deviates from the rest of the Asiatic species of the Elaps by an annulated body. The colour of the specimen preserved in spirits, is brownish red at the upper parts of the body, being somewhat paler in the midst of the scales, than at the edges; down the sides of the body this colour becomes more and more light, and passes at the under-parts into a yellowish white. The whole body from the neck to the end of the tail is surrounded by black rings about a line in breadth, which are generally placed at the distance of an inch, but sometimes nearer to each other. In a few places there are slight irregularities in the colouring the rings not reaching to the abdomen, and thus being only half rings. The row of scales, situated at the median line of the back, are here and there marked with a black point or streak. In the midst of the abdomen we find a row of irregular black spots, placed betwixt every two rings. The head has the colour of the under-parts, but its back is marked with two very broad cross bars, so that only the band of the muzzle, and a transversal band behind the eyes, are yellow. However, it is probable, that the colours of the living animal are very different. Total length 25 inches, 6 lines: length of the tail 2 inches, 3 lines: Scuta abdominalia 216: Scutella subcaudalia 27.

The hemipenis extends to the eighth subcaudal plate and is forked opposite the sixth. It is spinous throughout, the spines being fairly numerous and relatively uniform in size. Proximally, they are set along low, longitudinal, fleshy ridges, while mesially and distally each one is mounted on a rather globular base. Some of these bases are divided on their distal aspects, the resulting branches being more or less connected with adjacent bases by low ridges. Two short, conspicuous ridges, beset with numerous small spines, lie adjacent to the sulcus and somewhat nearer to the point of forking than to the base of the hemipenis. The lips of the sulcus are well developed and devoid of spines proximally. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—This species has been recorded from the following localities in China:

Kiangsi: Lushan; Pingsiang.  
Fukien: Chungan Hsien.  
Kwangtung: northern Kwangtung.  
Hainan: Kachek; Nodoa.  
Kwangsi: Lohsiang.

*Habits and Habitat*.—This snake was collected by me only in the high, forested mountains about Kuatun and Sanchiang on the Chinese mainland but

was secured at much lower altitudes on Hainan. Dr. Mell informs me that he collected it personally in open, level country at Pingsiang, a fact probably to be explained by the northern location of this city.

Wall (1918, l.c.) describes *macclellandi* as "eminently a jungle as well as a hill species" generally found at altitudes of from 4000 to 6000 feet. He also records specimens probably taken as low as 1000 feet.

*C. macclellandi* is sluggish and inactive. It does not strike or even bite when annoyed, nor does it assume a threatening posture (Wall, 1918, p. 629; Schmidt, 1927, p. 457).

Wall (1918, p. 630) quotes Fayrer as saying that *macclellandi* feeds chiefly on snakes, and the only concrete evidence of its choice of food substantiates this statement as shown by the following details:

In 1925 (p. 820) Wall recorded a specimen from Burma containing two examples of *Typhlops diardi*; in 1926 (p. 566), one from Maymyo that had eaten the same species, and another with a *Typhlops braminus* in its stomach.

American Museum No. 27777 from Hainan contains a specimen of *T. braminus*.

A specimen in the British Museum from the Darjeeling region obviously was killed in the act of swallowing a juvenile *Ophisaurus gracilis*.

In spite of the frequent references to this species in the literature, little has been recorded on its breeding habits. Wall (1912, p. 693) reports a 584 mm. specimen killed at Shillong in August with 6 undeposited eggs the longest of which measured 33.3 x 10.9 mm. The eggs contained embryos 25.4 to 38.1 mm. long. In 1926 (p. 566), he again secured a gravid female; this one measured 598 mm. and contained 14 eggs with embryos about 25 mm. in length. It was killed at Maymyo, August 8.

The 595 mm. example collected by me in Chungan Hsien between June 12 and July 20 contains 4 well-developed eggs (Pope, 1929, p. 465) without embryos large enough to be revealed by gross examination. An egg of average size measures 20 x 12 mm.

*Material examined*:—I have seen the following Chinese specimens: the type of *annularis* and 1 example each from the Lushan and Nodao, in the British Museum; 5 from Hainan, and 3 from Chungan Hsien, in the American Museum.

As indicated under *Hemibungarus kelloggi*, Boulenger's Kuatun record of *macclellandi* is actually based on a specimen of the former species.

*Remarks*:—*Calliophis macclellandi* presents two problems:

1. VARIATION IN VENTRAL COUNT. This problem does not involve Chinese material because the number of ventrals found in the latter is not unusual. On the other hand, Formosan specimens because of noticeably high counts have been set off as a distinct species, *formosensis*, by Thompson (1912, No. 3, p. 3). For the time being, at least, I see no objection to granting specific status to this form. Maki (1931, p. 161) gives counts of twelve Formosan

examples, only one of which falls below 217, while the average is 227 and the range 207-240. The single low count of 207 might well be an error. I am inclined to think that an accurate separation of sexes would prove the difference between Chinese mainland and Formosan material to be even greater than now supposed. Maki's color description shows that *formosensis* agrees closely in coloration with Fukien *macclellandi*, i.e., the dark bands completely encircle the body. This last point may later turn out to be of great importance.

*C. macclellandi* from Burma also exhibits considerable variation in ventral counts, but the different color patterns make the whole question there much more involved than the eastern one discussed above and consequently not so easily settled.

2. VARIATION IN COLOR PATTERN. Comparison of the three Chungan Hsien specimens before me with the five from Hainan almost convinces me that two forms are represented, a completely banded, northern form, and a southern one with greatly reduced bands or merely a row of dorsal spots. Moreover, additional Chinese material studied and described in the literature seems to confirm this conclusion, and I refrain from separating northern and southern Chinese material only because of the great color variation shown in Himalayan and Burmese *macclellandi* described by Wall (1918, p. 629, and 1925, p. 820). Do these "varieties" represent good geographical forms or are they only erratic variations not correlated with definite regions and habitats? If they represent valid forms, do these forms intergrade, and if so, where?

Nothing is known of the poison of this secretive snake (Wall, 1928, p. 31).

#### Genus *Hemibungarus* Peters

*Brachyrhynchus* Fitzinger, 1843, Syst. Rept., p. 28 (type, *Elaps calligaster*) (not of Laporte, 1833).

*Hemibungarus* Peters 1862, Monatsber. Akad. Wiss. Berlin, p. 637 (type, *Elaps calligaster*).

In addition to *kelloggi*, this genus includes *H. boettgeri* (Fritze) of Okinawa Shima, *H. japonicus* (Guenther) of the eastern Riu Kiu Islands group, *H. sauteri* (Steindachner) of Formosa, *H. nigrescens* of Peninsular India, and three Philippine species.

*Hemibungarus*, if its species actually constitute a genetic assemblage, is of special interest because it demonstrates the relationship of the Formosan and Riu Kiu faunas to those of the Philippine Islands and confirms other evidence in regard to the time of connection of Formosa to the Philippines.

#### OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SPECIES

Head black above, crossed by two yellowish bands, a wide one posteriorly and a narrow one on the snout; numerous, conspicuous, narrow, black cross-bands on the body; belly boldly blotched with black; scales smooth, in 15 rows throughout.

#### 100. *Hemibungarus kelloggi* Pope

Figure 67

*Callophis macclellandii* Boulenger, 1899, Proc. Zool. Soc. London, p. 166 (Kuatun, Fukien) (not of Reinhardt, 1844).

*Hemibungarus kelloggi* Pope, 1928, Amer. Mus. Novitates, No. 320, p. 6 (type locality, Chungan Hsien, Fukien); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 466, fig. 19 (amplified description of type and paratypes; 2 paratypes originally recorded from the type locality stated to be from Yenping and Futsing Hsien, Fukien, instead).

*Calliophis wongii* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 128, fig. 11 (type locality, Lohsiang, Kwangsi).

**Description:**—Loreal absent; upper labials 7, 3rd and 4th entering orbit; preoculars single; postoculars 2; anterior temporals single; posterior temporals 2; scales smooth, in 15 rows throughout; ventrals in males 191-194, females 196-202; subcaudals in males 29-38, females 33-34; dorsal bands 19-22 + 4; total length of males 660, 491, 454 and 193, females 542 and 201 mm. Single spots on middorsal scale row and paired series midway between crossbars present or absent. (Description based on the three paratypes of *H. kelloggi*; the type and paratype of *Calliophis wongii*; and the Kuatun specimen of *kelloggi* in the British Museum.)

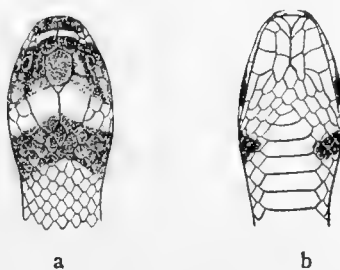


FIG. 67. *Hemibungarus kelloggi*. Type.  $\times 2$ . a. Dorsal view of head. b. Ventral view of head.

The original description of the type specimen, a female, follows:

Maxillary with a pair of large, grooved poison-fangs and 2 small, solid teeth separated by a space from the fangs. Rostral broader than deep; frontal a little longer than deep, as long as its distance from tip of snout, and much shorter than parietals. Diameter of eye equal to its distance from edge of lip; pupil round. Upper labials 7-7, third and fourth entering eye, sixth largest. Lower labials 6-6, four pairs in contact with anterior chin-shields. Preoculars 1-1; postoculars 2-2; anterior temporals 1-2; posterior temporals 2-2. Scales in 15 rows throughout. Ventrals 203; subcaudals 28, divided. Anal divided. Total length 774 mm., 0.09 of which is occupied by tail.

The dorsum is purplish brown with 3 sets of markings. The most conspicuous of these is made up of 22 light-edged, black cross-bands, each a scale length in width, distributed down the back and descending to the edge of the ventrals. They may even join the ventral spots. This set is continued on the tail where there are 3 additional bands. The second set of markings is composed of a series of paired, light-edged black spots, each about the size of a scale, located on either side of the central scale row midway between the cross-bands. On the tail these spots are a little irregular. The third set of markings is a broken series of small, black spots each occupying the center of a middorsal scale. These spots are absent on the neck, tail, and the scales adjacent to the cross-bands. The ventrum is milky white with 49 black blotches of varying size and outline disposed along its center. Five of the blotches fall behind the anus. The head is black, crossed by 2 white bands; a narrow one beginning on the second and third upper labials and crossing over the snout at the juncture of the prefrontals with the internasals; a much broader one with the form of a shallow V having its anterior edges on the posterior upper labials and its apex at the posterior tip of the frontal.

*Distribution*.—*H. kelloggi* is known only from Chungan Hsien (including Kuatun), Yenping and Futsing Hsien in Fukien; and Lohsiang in Kwangsi.

*Habits and Habitat*.—The meager data available indicate that *kelloggi* is a nocturnal inhabitant of mountain forests. The type and Chungan Hsien paratype were secured by me in the high, forested mountains about Sanchiang and Kuatun.

When annoyed, during the day at least, this snake does not assume a defensive posture but jerks about spasmodically. The brightly marked head is very conspicuous at night, the body correspondingly inconspicuous.

The type, secured between June 12 and July 20, contains 14 well-developed eggs, while the 542 mm. paratype, collected near Yenping on June 4, holds only 6 (Pope, 1929, p. 467). An egg of average size from the type measures 18 x 9 mm. and contains an embryo in the earliest stages of development measuring only a few millimeters.

*Material examined*.—I have seen the type and 3 paratypes, in the American Museum; and the example misidentified by Boulenger as *C. maccllellandi*, in the British Museum.

*Remarks*.—Due to the peculiar shape of the maxillary bone and the small size of the solid teeth on it, the latter are very hard to detect and I am convinced that re-examination of the material of Fan's *Calliophis wongii* will reveal solid maxillary teeth. His snake agrees too well with *H. kelloggi* to be considered a distinct species.

#### Genus *Naja* Laurenti

Although widely distributed over southern Asia and the Malay Archipelago, the species of *Naja* are numerically well represented only in Africa where they occur from Egypt to South Africa. The two species included in this work are the only ones known on the Asiatic mainland east of Persia.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Size large; loreal absent; neck expansible; scales smooth, oblique; vicious.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- |   |                           |
|---|---------------------------|
| I. An enlarged pair of contiguous occipital shields; scales in 15 rows at midbody.....      | <i>hannah</i> , p. 346    |
| II. No enlarged contiguous occipital shields; scales in 21 (rarely 19) rows at midbody..... | <i>naja atra</i> , p. 348 |

#### 101. *Naja hannah* (Cantor)

##### Plate XVI, A and B

*Hamadryas hannah* Cantor, 1836, *Asiat. Res.*, XIX, p. 87, Pls. x-xii (x and xi colored) (type localities, the Sundarbans and the jungle near Calcutta, Bengal).

- Naja bungarus* Schlegel, 1837, Phys. Serp., II, p. 476, Pl. xvii.—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 124 (Tsingyun, Tsungfa, Wuyung, Namkong and Lofaoshan, five Kwangtung localities).  
*Ophiophagus elaps* Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 86 (record of specimen seen in Hongkong City Hall Museum, probably of local origin).  
*Naja hannah* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 469 (Foochow given as locality but the specimen was actually killed near Foochow in the Kuliang-Kushan mountains).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 123 (Lohsiang, Kwangsi).

*Description*.—Loreal absent; upper labials 7, 3rd and 4th entering orbit; preoculars single; postoculars 3; anterior temporals 2; posterior temporals 2; scales smooth, oblique, in 19 rows on the neck, 15 at midbody and before the vent; ventrals in males 243-244, females 247-254; subcaudals in males 84-90, females 79-81; length of males 2230+472 and 2100+460 (body skinned), females 2120+373 and 1776+327. Color, generally olive brown, the dorsum crossed by 40-54 narrow, light bands boldly margined with black; posteriorly, these black margins gradually encroach upon the ground color until, on the tail, they entirely supplant it and the dorsal pattern consists of light bands on a black ground color; the belly is brown anteriorly with sparse traces of black which increase posteriorly until the black becomes predominant under the tail; the first light band on the neck is very narrowly outlined in black and V-shaped, the apex directed anteriorly; the head is brown, many of its sutures black. (Description based on one specimen from near Foochow and three from Lohsiang.)

Hatchlings are conspicuously banded with black and white throughout and therefore readily confused with other similarly colored species.

The king cobra rarely exceeds 15 feet in length (Wall, 1924, p. 194), but a specimen 18 feet 4 inches long is on record (Smith, 1930, p. 68).

The hemipenis is excessively long and deeply forked. Wall (1925, p. 820, and 1926, p. 564) has recently figured and described it in detail, while Cope illustrated it long ago (1895, Pl. xxxii, fig. 2). In view of the remarkable hemipenis and other striking anatomical peculiarities of this snake, one is, as recently reiterated by Wall, fully justified in recognizing it as generically distinct from *Naja*. I believe that anyone undertaking to revise the Elapidæ should assign *hannah* to a genus of its own, the name of which would of course be *Hamadryas*.

*Distribution*.—This species has been definitely recorded from the following localities in China:

Fukien: Kuliang-Kushan mountains (near Foochow).

Kwangtung: Tsingyun; Tsungfa; Wuyung; Namkong; Lofaoshan.

Kwangsi: Lohsiang.

There is little reason to doubt its presence on Hainan (Schmidt, 1927, p. 400), and its occurrence in northern Burma, not far from the Yunnan boundary (Boulenger, 1888, p. 602, and Wall, 1925, p. 820, and 1926, p. 564), indicates

that it is more widely distributed in extreme southern China than has been actually demonstrated.

Distributed from the Western Himalayas and Peninsular India eastward through Burma, parts of southern China, and the entire peninsula of south-eastern Asia, into the Malay Archipelago including the Philippines.

*Habits and Habitat*.—The following points of special interest have been abstracted from Wall's (1924, pp. 189-195) excellent general account of the king cobra:

1. It frequents dense jungles and is often found near streams (p. 191).
2. It sometimes ascends trees (p. 191).
3. It is markedly diurnal (p. 192).
4. It normally feeds on snakes but has been known to eat lizards (pp. 191-192).
5. It lays from 21 to 33 eggs which are deposited on a pile of leaves or vegetable rubbish and guarded by the female. The male may remain nearby during incubation (p. 193).
6. The eggs are probably deposited during April and May in Burma (p. 193).
7. Hatchlings measure from 508 to 533 mm. (p. 194).
8. It is ferocious and may attack without provocation but often avoids encounters by retreating even when annoyed (p. 191).

Mell (1929, p. 228 etc.) has made many interesting observations on the behavior and reactions of this snake in Kwangtung.

*Material examined*.—I have seen the specimen from the Kuliang-Kushan mountains, in the American Museum.

#### 102. *Naja naja atra* Cantor

Plate XVI, C, D and E

*Naja atra* Cantor, 1842, Ann. Mag. Nat. Hist., IX, p. 482 (type locality, Chusan Island).

*Naja tripudians* Duméril and Bibron, 1854, Erp. Gén., VII, p. 1293 (part: China).

*Naja tripudians* var. *scopinucha* Cope, 1859, Proc. Acad. Nat. Sci. Phila., XI, p. 343 (type locality, Chukiang, Kwangtung).

*Naja haji* Hallowell, 1860, Proc. Acad. Nat. Sci. Phila., XII, p. 504 (Hongkong harbor).

*Naja lutescens* var. *larvata* Steindachner, 1869, Reise Novara, Zool., I, Rept., p. 84 (Hongkong) (not of Cantor, 1839).

*Naja tripudians* var. *atra* Martens, 1876, Preuss. Exped. Ost-Asien, Zool., I, p. 177.

*Naja tripudians* var. *unicolor* Martens, 1876, Preuss. Exped. Ost-Asien, Zool., I, p. 382 (Canton) (substitute name).

*Naja tripudians* var. *fasciata* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 383 (part: Kiukiang, Kiangsi; Canton; Hoihow, Hainan).

*Naja tripudians* var. *sputatrix* Boulenger, 1896, p. 384 (part: Chusan Islands; China).

*Naja naja atra* Stejneger, 1907, Herp. Japan, p. 394.

*Naja naja atra* Barbour, 1909, Proc. New England Zool. Club, IV, p. 72 (Tingan, Hainan).

*Description*.—Loreal absent; upper labials 7; preoculars single; post-oculars 2 or 3, very rarely 1; anterior temporals 2, occasionally 1; posterior temporals 2, 3 or 4; scales smooth, oblique, in 25 (9 specimens), 26 or 23 (3 specimens each), or 24 (1 specimen) rows on the neck, 21, very rarely 19, at midbody and 15 before the vent; ventrals in five males 164-170, in eleven



females 167-178; subcaudals in three males 50, in six females 43-45; largest males from snout to vent 960 and 950, largest females 1135, 1045 and 925 mm., respectively. (Description based on ten specimens from Futsing Hsien, three from Yenping, one from Chungan Hsien and two from Hokow.)

I have brought together in Table XLVI all the available scale counts of *atra* from China, Formosa, Hongkong and Tongking except those given above. This table accompanies, the figures in parentheses indicating the number of specimens on which the counts are based.

This Table XLVI shows clearly how remarkably similar cobras from southeastern China, Formosa and Tongking are when scale rows, ventrals and subcaudals form the basis of comparison. Turning to the color descriptions of the Hainan (Schmidt, 1927, p. 453) and Fukien-Kiangsi (Pope, 1929, p. 471) series in the American Museum, it becomes at once evident that the variation in color contrasts rather strongly with the uniformity of scale characters. This lack of uniformity in pattern of Chinese material is not surprising in view of the fact that Asiatic cobras nearly everywhere exhibit a similar amount of variability. Obviously, then, variation in color remains to be correlated with variation in scale counts, and, since lack of material makes a thorough comparative study by me impossible, I shall record in detail only the differences found in the well-known dorsal design of the hood usually referred to as the spectacle. This design was insufficiently described in the two references just cited.

The spectacle of the Chinese cobra is really a mask-shaped figure, i.e., a wide, transverse black-margined white band crossing the hood and joining the light area of the throat. This band is much wider mesially than laterally and encloses a large central and two small lateral black spots. Such a figure I refer to as a complete or full mask, but, when the white band is interrupted on the sides by the dark ground color of the dorsum and thus prevented from connecting with the white of the throat, I speak of an isolated mask. Sometimes the central black spot is connected anteriorly with the black margin of the mask and its adjacent ground color, while various other modifications frequently occur. The most radical and important variation found is best described as an imperfect spectacle, and it is, in fact, nothing more nor less than the beginnings of the elongate or perfect spectacle of the south Indian cobra so well known in popular as well as technical literature. The point of fundamental importance here is the indisputable fact that the spectacle of the Indian form was derived directly from the mask of Chinese *atra*, and this derivation is well demonstrated by the variations found in the two series of *atra* tabulated below. The question presents itself, how did the mask itself arise? The answer might well be that one of the double white bands often seen on the body of Chinese specimens was developed into the mask by the widening of each of its components and the resultant better isolation of the enclosed

TABLE XLVI. VENTRAL, SUBCAUDAL AND SCALE ROW COUNTS OF *NAJA NAJA ATRA* FROM CHINA, TONGKING, FORMOSA AND HONGKONG

Locality	Sex	Scale Rows	Ventrals	Subcaudals	Museum or Reference
S. W. Hunan		25-21	167	49	Stejneger, 1925, p. 94
Kiukiang...		25-21	166	48	Boulenger, 1896, p. 383
Tunglu....	♂		(2)168-169	(2)42-45	Mus. Comp. Zool. Nos. 28831-28832
Tunglu....	♀		(2)172	(2)39-43	Mus. Comp. Zool. Nos. 28830, 28833
Chusan Ids.	♂	25-21	167		Boulenger, 1896, p. 384
Chukiang...		25-20	163	47	Cope, 1859, p. 343
Canton.....		25-21	170		Boulenger, 1896, p. 383
Canton.....		(4) ?-21	(4)162-169	(2)47-50	Boettger, 1885, p. 127
Hongkong..	♀	27-21	170	45	Stejneger, 1907, p. 397
Hainan.....	♂	neck: (6)27 (4)29 (3)25	(8)164-172	(7)41-51	Schmidt, 1927, p. 453
Hainan.....	♀	midbody: (12)21 (1)19	(5)169-177	(5)39-47	Schmidt, 1927, p. 453
Hainan.....		?-21	177		Boettger, 1888, p. 86
Tingan.....		25-21	173	43	Barbour, 1909, p. 72
Hoihow.....		25-21	168	43	Boulenger, 1896, p. 383
Lohsiang...	♂	(1) ?-21	(3)166-170	(3)49-51	Fan, 1931, p. 126
China.....		25-21	177	47	Boulenger, 1896, p. 384
Manson Mts.		25-21	168	50	specimen in British Museum
Tongking...		25-21	169	48	specimen in British Museum
Tongking...		27-21	164	50	specimen in British Museum
Formosa....	♂	(7)25-21	(3)166-169	(3)46-48	Maki, 1931, p. 158
Formosa....	♀	(1)27-21	(5)172-176	(5)41-46	Maki, 1931, p. 158
Formosa....	♂ + ♀	neck: (7)24 (4)25 (1)23 midbody: (11)21 (1)19	(12)165-178	(12)42-51	Maki, 1931, p. 158

ground color. This ground color would then only have to darken and become divided into the three spots to create the mask in its rudimentary form. After that, further widening of the mesial section of the total design and darkening of its margins would produce a complete mask. Unfortunately, such a derivation of the mask cannot be proved, since its primitive stages have not been actually seen.

SUMMARY OF VARIATIONS IN DORSAL HOOD DESIGN OF TWENTY-FIVE COBRAS IN  
THE AMERICAN MUSEUM

Fukien-Kiangsi Series, Nos. 21012, 21044, 33232-33, 33616, 33780-88 and 35051-52

- Mask complete in 3
- Mask isolated on one side in 1
- Mask isolated on one side, no spots, in 1
- Mask isolated on one side, a single spot, in 1
- Mask isolated in 1
- Large spot joined to anterior border in 1
- Mask isolated, large spot joined to anterior border, in 1
- Mask isolated on one side, large spot joined to anterior border, in 3
- Imperfect spectacle in 4

Hainan Series, Nos. 27831-33, 27835-40

- Mask complete in 4
- Mask isolated on one side in 2
- Mask isolated in 2
- Mask complete, a single spot, in 1

The largest male and female among Schmidt's (1927, l.c.) Hainan series of eight of the former and five of the latter sex measure 1488 and 1473 mm. in total length, respectively, while the greatest length reached on Formosa is 1654 mm. (Maki, 1931, p. 158). Schmidt's as well as Maki's data indicate that the sexes attain the same maximum length, an indication not fully borne out by the Fukien-Kiangsi series already described. The maximum length of the species in India is about 2000 mm., but specimens of such size are very rarely seen (Wall, 1921, p. 477).

The original description follows:

Iridescent black, with a number of distant transversal double lines of a yellow colour. The abdominal surface in some of a pearl, in others of a slaty colour.

The hemipenis extends to the tenth subcaudal plate and is forked opposite the seventh. Its proximal third is beset with numerous spines. These spines are abruptly superseded by a region of large ones which in turn is interrupted opposite the point of forking of the sulcus by a narrow, transverse, smooth area. This area does not, however, intercept the sulcus or its two adjacent, longitudinal ridges and is followed by more spines only slightly smaller than those that precede it. These last spines soon arrange themselves in more or less

evident rows, and this arrangement becomes increasingly conspicuous as the spines decrease in size and gradually become connected basally until the approximate distal fifth of the organ is calyculate, the calyces being poorly developed and having spinous edges. Two well-developed ridges lie immediately adjacent to the sulcus throughout its length. They are spinous save in the distal, calyculate region where they are calyculate. (Description based on a specimen from Futsing Hsien.)

Wall (1921, p. 473) says that the hemipenis of *Naja naja* is not bifid, while Cope long ago (1895, p. 210) diagnosed this organ in the genus *Naja* as bifurcate. In this connection, it is extremely interesting to find the hemipenis deeply forked in Chinese material but unforked in a specimen from the Punjab (American Museum No. 39397). It is only fair to state, however, that, although the hemipenis of this individual from northwestern India is not forked, its tip is double or, if viewed when in situ and before dissection, nicked. The sulcus is only shallowly forked, and the organ differs from the Chinese one described above in many minor details.

*Distribution*.—*Naja naja atra* has been recorded from the following localities in China:

Hunan: southwestern Hunan.

Kiangsi: Kiukiang; Hokow.

Chekiang: Chusan Island; vicinity of Sihü; Tunglu; Taichow; Wenchow.

Fukien: Ningteh; Pagoda Anchorage; Foochow; Futsing Hsien; Yenping; Chungan Hsien.

Kwangtung: Lamock Island; Canton; Chukiang.

Hainan: Hoihow; Nodda.

Kwangsi: Lohsiang.

The Chinese cobra is also well known from Formosa and Hongkong and undoubtedly occurs in Tongking. Lack of material has prevented my determining the limits of the range of *atra* to the southwest and west of the localities given above.

*Habits and Habitat*.—I found the cobra generally distributed in Fukien from the coast of Futsing Hsien onto the plateau of Chungan Hsien, but failed to find it in the mountains about Kuatun and Sanchiang, and doubt its occurrence there in spite of Stanley's 1914 (p. 30) record. Mell (1922, p. 124) reports it widely distributed in eastern Kwangtung from sea-level to 750 meters altitude, but more abundant on the southern plains and absent only from the dense forests of the northern mountains. In short, it frequents every type of habitat in southeastern China save the heaviest mountain forests.

One of the Hokow specimens in the American Museum contains two loaches (*Misgurnus anguillicaudatus*) and an eel (*Fluta alba*), while one from Futsing Hsien has two rodents, probably house rats, in its stomach (Pope,

1929, l.c.). Wall (1921, pp. 470-471) names frogs and toads, snakes, lizards, rats, birds and bird eggs as the natural food of *Naja naja* in India and Burma, and no doubt *N. n. atra* also eats these same animals.

Mell (1922, l.c.) records two Kwangtung clutches of 9 and 11 eggs which hatched the last third of August, data not in complete agreement with those already reported by me (1929, l.c.) and based on the Hokow female in the American Museum killed between June 28 and July 12 and containing 9 eggs, one of the largest measuring 60 mm. in length. The embryos in these eggs are very small, only about 10 mm. in length when unrolled, but the parent snake measures 1045 mm. from snout to vent. Certainly it is hard to believe that these eggs could have been deposited and hatched before late in September which is some time later than Mell's Kwangtung date, and it is quite as hard to see just how young cobras hatched so late in the year could survive in northern Kiangsi. The dates considered here should be compared to those of Wall, 1921, pp. 473 and 474, and 1922, p. 553. In the last reference, Wall gives May 12 and 19 as dates of deposition for *Naja naja naja* in the Karachi Museum and the period of incubation there as 47-54 days. He also describes the egg-tooth in detail and figures it as well.

Too much has been written on the habits of the cobra to summarize here. Mell (1929, p. 252, etc.) makes many interesting comparisons of the behavior of *atra* to that of various other snakes, while Schmidt (1927, p. 454) has already published my field account written at Nodda. This, in part, follows:

The cobra is common, as is shown by the number of specimens collected. . . . It has been a surprise to me that they can be so easily managed. I do not consider the cobra to be aggressive. None of our specimens showed any inclination to attack a man. Instead of showing fight when teased, they constantly attempt to escape, and only adopt a defensive attitude as the last resort. I have not seen a cobra outside. One was caught in a rat-trap, and one was found in the Mission compound. Small cobras are especially swift and agile, and older ones are alert and active. When they bite, they chew away until certain that their fangs have reached their mark. They quickly learn that it is useless to bite wood. When enraged, they will sometimes bite themselves.

The behavior of cobra and mongoose was tested twice, once with a five-foot snake and a small mongoose and once with a three-foot cobra and a large mongoose. Both cobra and mongoose gave every evidence of regarding their opponents as dangerous enemies and, when placed together in a room, each concentrated its attention on the other. Contrary to popular ideas of the mongoose's mode of attack, each of these specimens attacked the cobra at the moment when the latter struck, biting at the snake's open mouth so that snake and mongoose jaws became repeatedly interlocked. The snake's stroke was avoided, usually with a single motion of the head, except when it was caught in the open mouth of the mongoose. It is difficult to understand these tactics, for the snakes could scarcely fail to inoculate their enemy with poison. The small mongoose failed to kill its cobra, and died itself on the second day after the fight, but with no evident effects from the poison (it was apparently weak when brought to us). The larger mongoose killed its enemy and showed no ill effects from the

encounter. Neither mongoose made the slightest attempt to attack the cobra from behind. The larger mongoose repeatedly approached the cobra and lay down on its side, just beyond reach of the cobra's stroke, keeping its eyes fixed on the snake, and raising its head to keep it in view—a most peculiar and inexplicable performance.

The best general accounts of the Asiatic cobra are those of Wall, 1913, pp. 243-259 and 550-568; and 1921, pp. 459-496. One very interesting and significant fact emphasized by Wall (1921, p. 460) is the remarkable ability of the cobra to thrive in regions teeming with human life and activity of every description. The survival of this dangerous snake in India is commonly explained by its alleged immunity there from human attack, but such an explanation cannot apply to China, where it likewise persists even though, instead of being protected by religious beliefs, it is actually persecuted on account of its commercial value.

*Material examined:*—I have seen the following specimens from China: 1 each from Kiukiang, Canton, Hoihow, Chusan Islands, and China, in the British Museum; 1 from Tingan and 4 from Tunglu, in the Museum of Comparative Zoölogy; 2 from Foochow, 1 from Wenchow, and 1 from southwestern Hunan, in the U. S. National Museum; 13 from Nodoa, 10 from Futsing Hsien, 3 from Yenping, 1 from Chungan Hsien, and 2 from Hokow, in the American Museum.

*Remarks:*—Either collation of a series of cobras from widely separated localities, or perusal of the literature, or a study of the foregoing data will suffice to convince one that the problem of the separation and definition of the forms of *Naja naja* is a most complex one still awaiting final solution. The present treatment confirms Bannerman's (1905, p. 638) evidence that, while the coloration is nearly everywhere variable, yet this variation can be correlated with geographical areas; demonstrates the fact that certainly in China a form (*atra*) with very constant scale counts exists; and points out that the hemipenis itself varies within the species. From this we must conclude that the forms of *naja* cannot be worked out unless scale counts, color pattern and penial characters are taken equally into consideration. In addition to the literature already referred to, the work of Boulenger, 1896, p. 380; Stejneger, 1907, p. 394; Wall, 1907, p. 126, Pls. I and II; and Mertens, 1930, p. 320, should receive most careful consideration.

#### Family HYDROPHIIDÆ

I have been conservative in selecting the species of this family for inclusion because sea-snakes on the whole are not an important element in the Chinese ophidian fauna and records of certain species are problematical if not very dubious. The following remarks will serve to elucidate this matter:

*Laticauda*: three forms of this genus are known either from waters about Formosa or the Riu Kiu Islands or from both of these regions and one or more of them may possibly turn up in China. Species of this genus are readily recognized by their broad, well-developed ventrals, lateral nostrils, and the separation of the nasals by the internasals.

*Hydrophis inornatus*: Dr. Smith tells me that the Tsingtao specimens of *inornatus* in the Berlin Museum are too immature for certain identification.

*Hydrophis torquatus*: Smith (1926, p. 79) has already commented on the possibly incorrect records of this species for Canton and China.

*Hydrophis fasciatus*: the Chinese records for *fasciatus* are even more doubtful than those for the preceding species (Smith, 1926, pp. 96 and 99).

It must not be forgotten that old "China Seas" labels are not to be regarded as valid records for China, this term obviously having been applied to many parts of the Pacific Ocean far to the south of China.

All the sea-snakes are marine save *Hydrophis semperi*, of the Philippines, which inhabits a fresh-water lake.

#### KEY FOR IDENTIFICATION OF CHINESE GENERA

- I. Ventrals small but distinct throughout, not divided by a median suture
  - A. Maxillary with 5 teeth in addition to fangs; ventrals broad anteriorly, narrow posteriorly. . . . . *Thalassophina*, p. 356
  - B. Maxillary with 6-18 teeth in addition to fangs; ventrals uniform in width. . . . . *Hydrophis*, p. 357
- II. Ventrals much reduced in size or absent or divided by a median suture
  - A. Maxillary with 8-10 teeth in addition to fangs. . . . . *Pelamydrus*, p. 363
  - B. Maxillary with 3-6 teeth in addition to fangs
    1. Body excessively slender anteriorly; ventrals divided by a median suture. . . . . *Microcephalophis*, p. 365
    2. Body not excessively slender anteriorly; ventrals small or absent, never divided by a median suture. . . . . *Lapemis*, p. 362

This key is specifically designed for the identification of Chinese sea-snakes, a fact not to be overlooked.

As indicated by the descriptions given under the species treated below, the hemipenes of sea-snakes show a striking structural similarity and this in spite of the remarkably varied scutellation and external form that some species have assumed. These facts may perhaps be taken as evidence that the evolution of form and scutellation in this group has been very rapid, due no doubt to the far-reaching effects of the marine environment and its accompanying peculiarities. Perhaps, however, this penial conservatism is rather to be corre-

lated with the relative ease and convenience of copulation in an aquatic medium. No evidence of a dual origin of the family is afforded by the hemipenes.

Smith (1926, p. viii), in discussing and describing the hydrophiid hemipenis, remarked on its lack of structural diversity but did not emphasize this point. He failed to mention the fact that the organ itself is sometimes forked at the tip and stated that the sulcus is always divided, but I have seen a specimen of *Laticauda semifasciata* (Mus. Comp. Zool. No. 25981) in which this is not the case. Smith's figure of the *semifasciata* hemipenis (p. ix) is not accurate in some details, nor does it show that the edges of the calyces bear distinct spines save at the extreme tip of the organ.

I have examined the hemipenis of *Laticauda colubrina*, *Emydocephalus ijimae*, *Enhydrina schistosa* and *Acalyptophis peronii*, in addition to that of *L. semifasciata* and others as indicated among the species treated below.

#### Genus *Thalassophina* Smith

*Thalassophina* Smith, 1926, Monogr. Sea Snakes, p. 33.

This genus is monotypic.

#### 103. *Thalassophina viperina* (Schmidt)

##### Plate XVII

*Thalassophis viperina* Schmidt, 1852, Abh. Naturw. Ver. Hamburg, II, Abt. 2, p. 79, Pl. III (type locality, coasts of Java).

*Hydrophis (Thalassophis) viperinus* Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 91 (Hainan).

*Hydrophis viperina* Boulenger, 1888, Ann. Mag. Nat. Hist., (6) II, p. 44 (Hongkong; dentition).

*Thalassophina viperina* Smith, 1926, Monogr. Sea Snakes, p. 33, fig. 16 (Swatow, Kwangtung; complete account).

*Disteira veparina* Tchang, 1932, Bull. Fan Mem. Inst. Biol., III, p. 18 (Kwangtung)

*Description*.—Maxillary bears 5 teeth in addition to poison-fangs; head short, depressed, distinct from neck; prefrontals not in contact with labials; 7 to 9 upper labials, 3rd and 4th, 4th and 5th or 3rd to 5th entering orbit; usually 1, sometimes 2 or 3 anterior temporals. Scales uncarinate, in 27 to 34 rows on neck, 37 to 50 on body; ventrals (181) 226-274, about six times as large on neck as before vent. Color gray above, light below, the dorsal gray sometimes developed into alternate light and dark areas. Total length of male 925, tail 100 mm.; of female 820, tail 80 mm. (Description based on that of Smith, 1926, p. 34.)

The Hainan example collected by Herz has 31 scale rows on the neck and 238 ventrals (Boettger, 1888, p. 91), while Smith (1926, p. 36) gives the counts of the Swatow female as 32 and 47 scale rows and 256 ventrals. Another Kwangtung specimen has 49 scale rows and 272 ventrals (Tchang, 1932, p. 19).

The ventrals in the males are bituberculate (Stejneger, 1907, p. 434).



The hemipenis is entirely spinous save at its base, where it is smooth, and at its extreme tip, where some of the spines are replaced by small papilla-like processes. The spines are long and slender and relatively uniform save for a slight reduction in size distally. The sulcus is divided near the tip of the organ, its lips moderately prominent and spinous. The smooth basal region of the hemipenis bears a small, smooth lip. (Description based on a specimen from the Gulf of Siam.)

*Distribution*.—This sea-snake is reported from Hainan and Swatow in China. There is also a Hongkong record.

Distributed from the Persian Gulf to southeastern China and the Malay Archipelago.

*Material examined*.—I have seen the Hongkong specimen in the British Museum but no actual Chinese material. It was received from the Hongkong City Hall Museum.

*Remarks*.—Smith (1926, l.c.) has examined the Swatow specimen in the Hongkong City Hall Museum.

#### Genus *Hydrophis* Latreille

According to Smith, this genus, distributed from Asia to northern Australia, embraces about half the known species of sea-snakes.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Ten to 18 maxillary teeth in addition to fangs
  - A. Ten to 13 maxillary teeth in addition to fangs. . . . . *o. ornatus*, p. 361
  - B. Fourteen to 18 maxillary teeth in addition to fangs. . . . . *cærulescens*, p. 357
- II. Five to 8 maxillary teeth in addition to fangs
  - A. Body slender anteriorly; normally a single, large anterior temporal. . . . . *melanocephalus*, p. 360
  - B. Body not slender anteriorly; two superimposed anterior temporals. . . . . *cyanocinctus*, p. 358

#### 104. *Hydrophis cærulescens* (Shaw)

#### Plate XVIII

*Hydrus Cærulescens* Shaw, 1802, Gen. Zool., III, p. 561 (type locality, East India).

*Hydrophis cærulescens* Smith, 1926, Monogr. Sea Snakes, p. 90, fig. 26 (Tsingtao, Shantung; complete account).

*Description*.—Maxillary bears 14 to 18 teeth in addition to poison-fangs; head moderately small, body not very slender anteriorly, compressed posteriorly, its greatest diameter 2 to 3 times that of neck; prefrontal in contact with second upper labial; 7 or 8 upper labials, 3rd and 4th entering orbit; 2 or 3 anterior temporals. Scales strongly keeled, in 31 to 43 rows on neck, 38 to

54 on body (increase 6 to 14); ventrals 253-334, distinct throughout. Color bluish gray above, yellowish white below, banded, the bands narrowed ventrally where they may be incomplete; pattern becomes indistinct with age. Total length of male 820, tail 100 mm., of female 740, tail 65 mm. (Description based on that of Smith, 1926, p. 90.)

The two Tsingtao specimens, both males, have, respectively, 36 and 41 rows of scales on the neck, 44 and 49 at the largest part of the body, and 286 and 292 ventrals (Smith, 1926, p. 93).

The hemipenis is entirely spinous, save at its base, where it is smooth, and at its tip, where the spines are replaced by papilla-like processes. The spines are short and thick and uniform in size. The sulcus is divided near the end of the organ, its lips raised and spinous. The smooth, basal region of the hemipenis bears a small, smooth lip. (Description based on a specimen from the Gulf of Siam.)

*Distribution*.—The occurrence of this snake from Bengal to Cochin-China is well established, but the two specimens in the Berlin Museum from Tsingtao, Shantung, extend its range greatly. Smith (1926, p. 91) remarks on this, having secured evidence that the Tsingtao record is reliable, but he was apparently unaware of Martin's 1877, p. viii, record for Swatow. *H. caerulea* is also known from the East Indies.

*Habits and Habitat*.—This species produces from 2 to 6 living young at a time (Wall, 1921, p. 377).

*Remarks*.—Smith (1926, p. 92) lists the type of *caerulea* as from the Indian Ocean.

#### 105. *Hydrophis cyanocinctus* Daudin

Figure 68

*Hydrophis cyanocinctus* Daudin, 1803, Hist. Nat. Rept., VII, p. 383.—Smith, 1926, Monogr. Sea Snakes, p. 56, fig. 20 (Hainan Strait, complete account).

*Hydrophis (Hydrophis) cyanocinctus* Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 88 (Hainan).

*Disteira cyanocincta* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 30 (Foochow); 1917, p. xii (Hoihow, Hainan).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 94 (Shanghai).

*Disteira* sp. Ping, 1926, Trans. Sci. Soc. China, IV, p. 45, text fig. (Yenting, Chekiang).

*Description*.—Maxillary bears 5 to 8 teeth in addition to poison-fangs; head moderate; body elongate, not slender anteriorly, compressed posteriorly, greatest diameter in adult two to two and a half times that of neck; second upper labial in contact with prefrontal; 7 or 8 upper labials, 3rd and 4th, 4th and 5th or 3rd to 5th entering orbit; 2 superimposed anterior temporals. Scales keeled or tuberculate, in (25) 27 to 35 rows on neck, 37 to 47 on body (increase 8 to 14); ventrals 290-390, distinct throughout. Color variable but generally yellowish or olive with black bands more or less completely encircling the body,

sometimes a black ventral stripe; the black colors (especially of ventrum) tend to fade with age. Total length of male 1500, tail 130 mm.; of female 1885, tail 135 mm. (Description based on that of Smith, 1926, p. 56.)

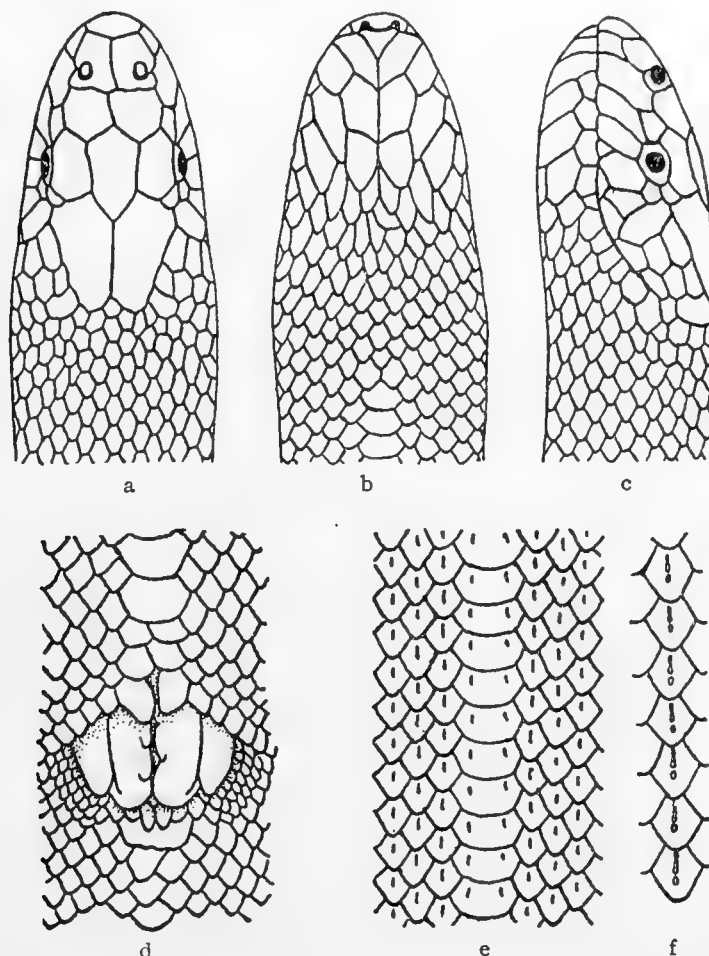


FIG. 68. *Hydrophis cyanocinctus*.  $\times 2$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. d. Cloacal region. e. Ventrals. f. Scales of middorsal row. Specimen from Japanese Empire. (From Maki.)

Thirteen Hainan specimens have 29 to 31 scale rows on the neck and 309-381 ventrals (Boettger, 1888, p. 89, and Smith, 1926, p. 52), while two males from the Foochow region have 337 and 326 ventrals, scale rows 27-37-32 and 27-41-35, respectively, the counts taken a head-length behind the head, at the largest part of the body, and a head-length before the vent (Pope, 1929, p. 472).

This snake may attain a total length of 7 feet (Wall, 1921, p. 363).

The scales and ventrals of the males have more strongly developed keels and tubercles (Stejneger, 1907, p. 429, and Wall, 1921, p. 362).

The hemipenis, scarcely forked at the tip, is entirely spinous, save at its base, where it is smooth, and at its extreme tip, where the spines are replaced by papilla-like processes. The spines are long and relatively uniform but decrease in size distally. The sulcus is bifid near its extremity, its lips spinous. The smooth, basal region of the organ bears a small, smooth lip. (Description based on a specimen from Hainan Strait.)

*Distribution*.—In China, this sea-snake has been reported from Hoihow; Hainan Strait; Foochow; Yenting in Chekiang; and Shanghai.

Distributed from the Persian Gulf to Japan and the Indo-Australian Archipelago. In Japan, it is well known from Riu Kiu and Formosan waters.

*Habits and Habitat*.—Smith (1926, p. 59) says that *cyanocinctus* "appears to be the commonest sea-snake in the Straits of Hainan."

From 3 to 15 young are produced at one time by this ovoviviparous snake (Wall, 1919, pp. 433-437, and 1921, l.c.).

*Material examined*.—I have seen 3 specimens from Hainan, in the British Museum; 4 from Hainan Strait, in the Museum of Comparative Zoölogy; 1 each from Shanghai and Foochow, in the U. S. National Museum; and 3 from the region of Foochow, in the American Museum.

*Remarks*.—Mr. Mangven Chang has kindly re-examined the Yenting snake described by Ping (1926, p. 45) and identified it as *cyanocinctus*. In his letter he states that a second specimen has been received from Yenting.

#### 106. *Hydrophis melanocephalus* Gray

##### Plate XIX

*Hydrophis sublavus* var. *Melanocephala* Gray, 1849, Cat. Snakes Brit. Mus., p. 53 (part: type locality, "Indian Ocean").

*Disteira melanocephala* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 30 (Wenchow, Chekiang).

*Hydrophis melanocephalus* Smith, 1926, Monogr. Sea Snakes, p. 64 (China; complete account).

*Description*.—Maxillary bears 6 to 8 teeth in addition to poison-fangs; head small; body long and slender anteriorly, much compressed posteriorly, its greatest diameter 2 to more than 3 times that of neck; prefrontal in contact with second upper labial; 7 or 8, rarely 6, upper labials, 3rd and 4th or 3rd to 5th entering orbit, last 2 or 3 very small; normally a single large anterior temporal. Scales usually keeled, in 23 to 27 rows on neck, 33 to 41 on body (increase 8 to 14); ventrals 289-358, distinct throughout, bicarinate. Color gray or olive above, yellowish or white below, with numerous blackish bands wider above and below and more or less confluent below; dark bands wider in juveniles. Total length of male 1130, tail 95 mm.; of female 1230, tail 90 mm. (Description based on that of Smith, 1926, p. 64.)

The hemipenis of a Riu Kiu specimen is much like that of the Hainan Strait *H. cyanocinctus*.

*Distribution*.—In China, this species has been reported from Wenchow in Chekiang. It is known only from the seas about Formosa and the Riu Kiu Islands where it is apparently common. There is a record for the Pescadores Islands, and Smith (1926, p. 66) has examined specimens from "China" in the Berlin Museum. These might well have come from Formosa because that was formerly a part of China.

*Remarks*.—Stanley (1914, p. 30) gives no description of his specimen from Wenchow, so there is no way of checking his identification. There is, however, no reason to doubt the occurrence of this locally distributed species on the coast of China.

107. ***Hydrophis ornatus ornatus*** (Gray)

Figure 69

*Aturia ornata* Gray, 1842, Zool. Misc., p. 61 (type locality, Indian Ocean).

*Hydrophis ornatus* Smith, 1926, Monogr. Sea Snakes, p. 81, fig. 24 (Tsingtao, Shantung; complete account).

*Description*.—Maxillary bears 10 to 13 teeth in addition to poison-fangs; head large; body robust, not markedly elongate, the greatest diameter posteriorly about half that of neck; prefrontal normally in contact with second upper labial; 7 or 8 upper labials, 3rd and 4th entering orbit; 2 superimposed anterior temporals. Scales keeled, in 28 to 37 rows on neck in males, 31 to 45 in females; 33 to 45 on body in males, 39 to 55 in females (increase 4 to 12); ventrals 209-260 in males, 236-312 in females, distinct throughout. Color pale grayish or olive above with broad dark bars or rhomboidal spots; yellowish or whitish below. Total length of male 950, tail 115 mm.; of female 860, tail 80 mm. (Description based on that of Smith, 1926, p. 81.)

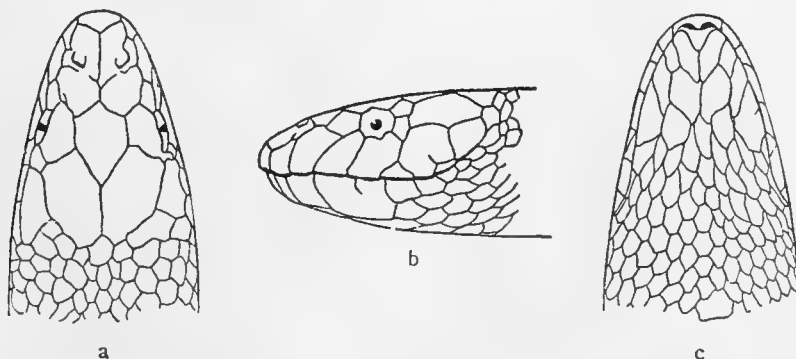


FIG. 69. *Hydrophis ornatus ornatus*.  $\times 1\frac{1}{2}$ . a. Dorsal view of head. b. Lateral view of head. c. Ventral view of head. U.S.N.M. No. 33933 from Ishigaki Island. (From Stejneger.)

The Tsingtao female has 37 and 47 scale rows and 236 ventrals, while her

6 offspring average 300 mm. in length and have from 209 to 257 ventrals (counts taken on only five examples) (Smith, 1926, p. 83).

Taylor (1922, p. 243) states that the female has only 2, the male 3 pairs of anals, while, in the former sex, the nasal is usually broken in two. He also examined adult females whose scales were devoid of tubercles. Maki (1931, p. 188) finds that the anal scales of the male are more tuberculate than those of the female.

The hemipenis of a specimen in the Museum of Comparative Zoölogy entirely lacking data, but identified as *H. ornatus ocellatus*, is generally spinous, the spines relatively uniform but reduced in size distally. The sulcus is divided near the tip of the organ and its lips bear small spines. There is a small, smooth fleshy lip on the smooth area at the base of the organ.

*Distribution*.—This form has been reported only from Tsingtao in China.

Distributed from the Persian Gulf to the Riu Kiu Islands; Formosa; and Shantung. There are numerous records for Ishigaki Island.

*Habits and Habitat*.—Smith (1926, l.c.) lists 6 juveniles, 3 of each sex, as the young of the Tsingtao specimen in the Berlin Museum.

This species "feeds for the most part on eels," but will take dead fish in captivity (Taylor, 1922, p. 245).

#### Genus *Lapemis* Gray

In addition to *hardwickii*, only one other species, *curtus*, is included in this genus. It is found from the Arabian coast to that of eastern Peninsular India.

#### 108. *Lapemis hardwickii* Gray

##### Plate XX

*Lapemis hardwickii* Gray, 1834, Illus. Ind. Zool., II, Col. Pl. LXXXVII, fig. 2 (type locality, India).—Smith, 1926, Monogr. Sea Snakes, p. 108, fig. 32 (Tsingtao, Shantung; Formosa; complete account).—Maki, 1931, Monogr. Snakes Japan, p. 190, fig. 128, Col. Pl. LXIX (Tainan, Formosa).

*Description*.—Maxillary bears 3 to 6 teeth in addition to poison-fangs; head large; body short, stout, diameter of neck half or more than half greatest diameter of body; prefrontal normally in contact with second upper labial, sometimes separated from it by a pseudo-loreal; 7 or 8 upper labials, 3rd and 4th entering orbit; 2, rarely 3, anterior temporals. Scales in 23 to 31 rows on neck in males, 27 to 35 in females; 25 to 37 on body in males, 33 to 41 in females; each lowermost lateral scale with a tubercle which may be strongly spinous in adult males; ventrals, if present, 114-186 in males, 141-230 in females, not as large as adjacent scales except anteriorly, with 1 or 2 tubercles to a plate. Color variable but usually greenish or yellowish olive above, light below with pale olive to dark gray dorsal bars tapering to a point on the sides.

Total length 860, tail 85 mm. (Description based on that of Smith, 1926, p. 109.)

The two Tsingtao specimens, both males, have, respectively, 27 and 25 rows of scales on the neck, 29 at the largest part of the body, and 148 and 153 ventrals (Smith, 1926, p. 112).

The hemipenis of a specimen of this species from Siam is figured by Cope (1895, Pl. xxxi, fig. 10). The organ is spinous with papilla-like processes at its extreme tip. The sulcus is divided near the end of the organ.

*Distribution*.—*L. hardwickii* has been reported only from Shantung (Tsingtao), in China.

Distributed from the Mergui Archipelago to China, the Philippines, and northern Australia.

*Material examined*.—I have seen the specimen labeled Hongkong in the Museum of Comparative Zoölogy, and, even though there is no reason to doubt the presence of this species at Hongkong, the specimen in question is of very uncertain origin.

*Remarks*.—The occurrence of this species in the waters surrounding Formosa and washing the Chinese coasts to the north of that island has long been problematical, but Maki's (1931, p. 190) record of a Formosan specimen, taken in 1929, and the Tsingtao examples in the Berlin Museum examined by Smith (1926, p. 112), go a long way toward solving this difficult problem.

#### Genus *Pelamydrus* Stejneger

*Pelamydrus* Stejneger, 1910, Proc. U. S. Nat. Mus., XXXVIII, p. 111.

This genus is monotypic.

#### 109. *Pelamydrus platurus* (Linnæus)

Figure 70

*Anguis platura* Linnæus, 1766, Syst. Nat., ed. 12, I, p. 391 (type locality unknown).

*Pelamis bicolor* Martin, 1877, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XI, p. viii (Swatow, Kwangtung).

*Hydrus platurus* Stanley, 1914, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLV, p. 30 (Pratas Id.); 1916, XLVII, p. xiv (Hoihow, Hainan).—Tchang, 1932, Bull. Pan Mem. Inst. Biol., III, p. 19 (Kwangtung).

*Pelamis platurus* Smith, 1926, Monogr. Sea Snakes, p. 116, fig. 33 (complete account).

*Pelamydrus platurus* Maki, 1931, Monogr. Snakes Japan, p. 192, fig. 129, Col. Pl. LXX (Tamsuy and Kiirun, Formosa).

*Description*.—Maxillary bears 7 to 11 teeth in addition to poison-fangs; head narrow, snout elongate; body greatly compressed, its greatest diameter posteriorly less than twice that of neck; second upper labial in contact with prefrontal; 7 or 8 upper labials, 4th and 5th usually separated from eye by suboculars; 2 or 3 small anterior temporals. Scales in 49 to 67 rows, each lowermost lateral scale with 2 or 3 small tubercles more strongly developed in males; ventrals 264-406, divided by a median suture or broken up. Color

extremely variable, but in Chinese and Japanese specimens there is usually a black vertebral stripe sinuous in outline or broken up posteriorly into spots; yellow on sides and below. Total length of male 720, tail 80 mm.; of female 880, tail 90 mm. (Description based on that of Smith, 1926, p. 117.)

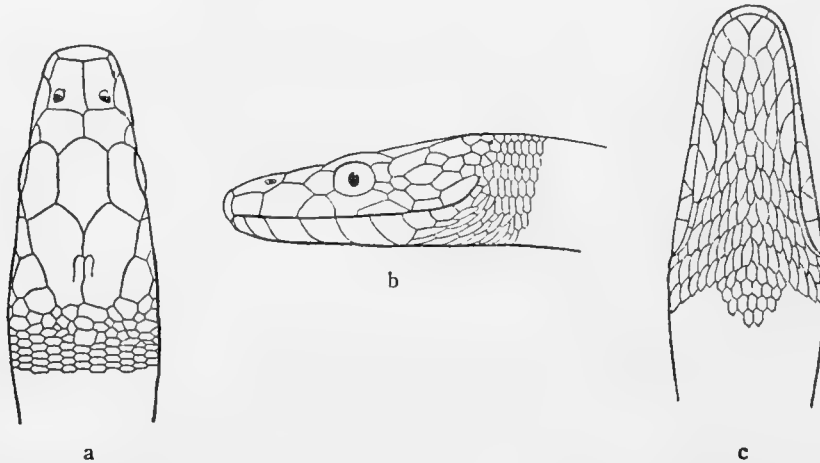


FIG. 70. *Pelamydrus platurus*.  $\times 1\frac{1}{3}$ . a. Dorsal view of head. b. Lateral view of head. c. Ventral view of head. (From Stejneger.)

A specimen from Kwangtung has 51 scale rows but no differentiated ventrals (Tchang, 1932, p. 20).

The hemipenis of a specimen from the "Pacific Ocean" is figured by Cope (1895, Pl. xxxii, fig. 5). The organ is spinous with papilla-like processes at its tip. The sulcus is divided at the extreme end of the organ.

*Distribution*.—*P. platurus* has been recorded in China from Hoihow on Hainan; Swatow in Kwangtung; and Kwangtung. It is also reported from Pratas Island.

There are stray records for this species as far north as the main Japanese Islands and even Possiet Bay, but no specimen has been secured in the latter bay within the last fifty years (Emelianov, 1929, p. 83). The Formosan records are numerous enough to prove that *platurus* regularly reaches the seas surrounding that island. Horikawa (1930, p. 20) gives a recent record for the Pescadores Islands.

This, the most widely ranging sea-snake and the only one that has crossed the Pacific, is found throughout the Indo-Australian seas, northward to Japan and China, and eastward to the American coasts.

*Habits and Habitat*.—Wall (1921, p. 423) records data indicating that the young of this ovoviviparous species are born in the spring (March and April) about Ceylon. One female examined by him held 2 advanced embryos 244 and 254 mm. in length. It was killed near Ceylon on March 9.



*Material examined*.—I have seen two examples with no more definite locality than China, one in the British Museum, and the other in the U. S. National Museum.

Genus **Microcephalophis** Lesson

In addition to *gracilis*, this genus includes only *cantoris*, which is distributed from the coasts of India and Burma to those of the Malay Peninsula.

110. **Microcephalophis gracilis gracilis** (Shaw)

Plate XXI

*Hydrus Gracilis* Shaw, 1802, Gen. Zool., III, p. 560 (type locality not given).

*Hydrophis (Microcephalophis) gracilis* Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 90 (Hainan).

*Microcephalophis gracilis* Smith, 1926, Monogr. Sea Snakes, p. 121, fig. 34 (Hainan Strait and Hongkong; complete account).

*Description*.—Maxillary bears 5 or 6 teeth in addition to poison-fangs; head very small; snout projecting beyond lower jaw; body long and excessively slender anteriorly, much compressed posteriorly, its greatest diameter 4 or 5 times that of neck; second upper labial usually in contact with prefrontal; 6 upper labials, 3rd and 4th entering orbit; anterior temporals single. Scales in 17 to 19 rows on neck, 30 to 36 on body (increase 12 to 16), tuberculate or with denticulate keels; ventrals 220-287, entire anteriorly, divided posteriorly. Color in young black with whitish dorsal bands or oval lateral spots anteriorly, more or less completely banded posteriorly; markings become indistinct with age. Total length of male 950, tail 80 mm.; of female 1025, tail 95 mm. (Description based on that of Smith, 1926, p. 121.)

The two Hainan specimens reported by Boettger (1888, p. 90) have 19 rows of scales on the neck, 261 and 291 ventrals, while a female from Hainan Strait has 17 and 33 scale rows and 278 ventrals, a male from the same locality 19, 33 and 244, scale rows and ventrals, respectively (Smith 1926, p. 123).

The tubercles or keels of the scales are more prominent in adult males (Wall, 1921, pp. 327 and 330).

The hemipenis is entirely spinous except at its base where it is smooth. The spines are uniform save for a general reduction in size distally. The sulcus is divided near the tip of the organ, its lips not conspicuous or raised. (Description based on a specimen from Perak.)

*Distribution*.—This remarkable snake has been secured repeatedly in the seas surrounding Hainan. There is a single Hongkong record that is at least questionable.

Distributed from the Persian Gulf to China and New Guinea.

*Habits and Habitat*.—This species feeds on eels and produces from 1 to 6,

usually 2, living young at a time, which are born in July and August in the seas about Peninsular India (Wall, 1918, p. 602, and 1921, pp. 326 and 327).

*Material examined*.—I have seen one immature specimen collected by Smith in the Hainan Strait and now in the British Museum, and the Hongkong example in the Museum of Comparative Zoölogy. This Hongkong *gracilis* has been examined by Smith (1926, p. 123) and referred to above.

#### Family AMBLYCEPHALIDÆ

This family, as here understood, includes only two genera, namely, *Haplopettura* with its single species, *boa*, found in the Malay Peninsula and Archipelago, and *Amblycephalus*. These snakes bear remarkable external resemblance to New World species of the genera *Sibynomorphus* and *Dipsas*; in fact, Boulenger (1896, p. 439) included these two genera, together with *Pseudopareas*, in the Amblycephalidæ. Dunn (1928, p. 19) has recently commented on this question.

#### Genus *Amblycephalus* Kuhl

*Amblycephalus* Kuhl, 1822, Isis, p. 474 (nomen nudum).

*Amblycephalus* Boie, 1827, Isis, p. 519 (type, *A. laevis*).

*Pareas* Wagler, 1830, Nat. Syst. Amphib., p. 181 (type, *Dipsas carinata*).

*Eberhardtia* Angel, 1920, Bull. Mus. Hist. Nat., Paris, XXVI, p. 291 (type, *E. tonkinensis*).

This genus is distributed from the Eastern Himalayas across Burma and southern China to Formosa, thence southward into the Malay Archipelago. Like *Trimeresurus*, it calls for much further study because the characters distinguishing its various species are not like those of snakes in general and have caused much confusion in regard to the status of certain forms.

*A. macularius* has been collected in Burma not far from the western border of Yunnan but no actual Chinese record exists (Wall, 1926, p. 566).

The snakes of this genus apparently subsist entirely on snails and slugs (Werner, 1912, pp. 399-400, and Wall, 1922, p. 21, 1926, p. 566; also below). Their long, slender, delicate teeth seem well adapted to the diet of slugs and snails.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Size small; body usually much compressed; head distinct from neck, snout blunt; no mental groove; internasal in contact with loreal; scales in 15 rows throughout.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

##### I. Loreal broadly entering eye; preocular absent

- |   |                            |
|---|----------------------------|
| A. Ventrals 175-189; subcaudals 63-69; upper labials eight; scales smooth.....                    | <i>boulengeri</i> , p. 367 |
| B. Ventrals 151-160; subcaudals 48-60; seven or eight upper labials; middorsal scales keeled..... | <i>stanleyi</i> , p. 376   |

## II. Loreal excluded from or barely entering eye; preocular present

- A. Uniform dark grayish brown above, a few black scales with white proximal tips scattered along the dorsum, these scales sometimes more or less regularly disposed to form narrow cross-bands; top of head devoid of pattern..... *moellendorffi*, p. 373
- B. Light tawny brown above with numerous, irregular black spots or cross-bands which may (in *niger*) be predominant; head tawny brown with a black or blackish pattern (quite black in *niger*)
  - 1. Predominantly black above; head black, without pattern; ventrals 165; subcaudals 64..... *niger*, p. 375
  - 2. Predominantly light tawny brown above; head tawny brown with a black or blackish pattern; more than 165 ventrals
    - a. Tip of loreal entering eye; ventrals 171-176; scales keeled..... *yunnanensis*, p. 381
    - b. Loreal excluded from eye (or occasionally entering it in *chinensis*); ventrals 175-194; scales smooth (sometimes weakly keeled in *chinensis*)
      - (1) Seven to 9 maxillary teeth..... *tonkinensis*, p. 378
      - (2) Four to 6 maxillary teeth
        - a'. Ventrals 175-180; subcaudals 60-74.. *chinensis*, p. 369
        - b'. Ventrals 180-194; subcaudals 72-93.. *kuangtungensis*, p. 371

The above key cannot be expected to work in every case because many characters are extremely unstable in *Amblycephalus* and sutures not easily followed between the unusually thin and delicate head plates. However, until much more is known of these interesting snakes, their rather restricted ranges should help a great deal in identifications. Acquisition of new material from intermediate regions may show that some of the forms now granted specific status must be reduced to subspecies or even to synonymy. I strongly suspect that *yunnanensis* and *niger* will prove to be identical.

III. *Amblycephalus boulengeri* Angel

Figure 71

*Amblycephalus Boulengeri* Angel, 1920, Bull. Mus. Hist. Nat., Paris, XXVI, p. 113 (type locality, Kweichow).—  
 Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 459, fig. 15 (Luanshihkou, Szechwan).  
*Amblycephalus chinensis* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 540 (part: Luanshihkou).

*Description*.—Upper labials 8, excluded from orbit; loreal enters orbit; preoculars absent; anterior temporals 2; posterior temporals 2; scales smooth, in 15 rows throughout, vertebral row not enlarged; ventrals 177; subcaudals 63; total length 495 mm. (Description based on the female from Luanshihkou.)

Angel's two adult cotypes measure 470 and 460 mm. total length, 103 and 93 mm. tail length, respectively.

The value of the following characters that seem to be characteristic of *boulengeri* requires further study:

1. The imbricate condition of the anterior lower labials (Pope, 1929, p. 459).
2. The relatively large size of the sixth or seventh lower labial. This character holds good for the four specimens of *boulengeri* that I have seen but does not always serve to distinguish it from *chinensis*; this labial often being enlarged in that form.
3. The number of lower labials in contact with the anterior chin-shields (Pope, 1929, l.c.).

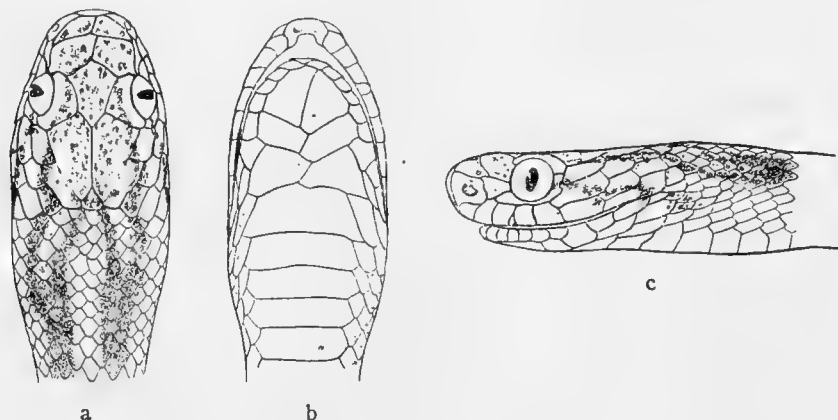


FIG. 71. *Amblycephalus boulengeri*.  $\times 4$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 23505 from Luanshihku, Szechwan.

A translation of the original description, based on the three cotypes, follows:

Rostral slightly broader than high, a little visible from above; internasals shorter than the prefrontals, which are broadly in contact with the eye; frontal six-sided but of a triangular aspect, notwithstanding the obtuse angle formed by its suture with the prefrontals; parietals larger ( $1\frac{1}{4}$  times) than the frontal; loreal touching the eye, longer than broad, but higher in front than behind; no preocular or postocular; two suboculars whose very narrow suture is just below the center of the eye, separating it clearly from the labials. The posterior subocular extends considerably farther up the eye than the anterior, thus replacing the missing postocular. Temporals 2 + 3. Eight upper labials, the eighth a good deal longer than the preceding ones. The two anterior lower labials meet behind the symphysis. Three pairs of chin-shields, the first pair larger than the other two. Scales in 15 rows, perfectly smooth. Ventrals 175-189. Anal simple. Subcaudals 65-69. Body compressed.

Very light brown on the dorsal surface of the body, scarcely paler below. On each side of the head a narrow dark brown line, more or less interrupted, extends from the posterior border of the eye to the angle of the mouth. Above, another stronger line, starting from the supraocular plate, proceeds along the head on the side of the parietals and then along the neck, where it is soon interrupted to form irregular spots which become more and more attenuated and disappear as they approach the end of the body. The ground color, above and

below, is speckled with numerous and fine dark brown points, which are larger and also grouped in small spots on the head plates. On a young individual this system of coloration is more distinct, the lines and spots of the anterior portion are better defined and show more plainly on the ground color.

*Distribution*.—*A. boulengeri* is known only from the type locality (Kweichow) and the region of Wanhsien (Luanshihkou) in eastern Szechwan.

*Habits and Habitat*.—The Luanshihkou specimen was taken at an altitude of about 3000 feet.

*Material examined*.—I have seen the 3 cotypes, in the Paris Museum; and the specimen from Luanshihkou, in the American Museum.

*Remarks*.—It is entirely possible that *boulengeri* is very closely allied to *chinensis*, but until proof of such alliance is forthcoming I prefer to give *boulengeri* full specific rank. A comparison of hemipenes would doubtless do more than anything else to settle this question.

#### 112. *Amblycephalus chinensis* Barbour

##### Plate XXII, A

*Amblycephalus chinensis* Barbour, 1912, Mem. Mus. Comp. Zool., XL, p. 132, Col. Pl. II (type locality, Luluping, Szechwan).—Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 93 (Sungpan road, 50 miles northwest of Kwanhsien, Szechwan).

*Description*.—The original description of the type specimen, a female, follows:

Rostral not quite as deep as broad; internasals not half as long as prefrontals; latter entering orbit; frontal slightly longer than broad, longer than its distance from the end of the snout, much shorter than the parietals; loreal present but excluded from entering orbit by two rather small preoculars; two postoculars, which on one side are fused into one; temporals 2 + 3; seven upper labials of which the fourth barely enters the orbit on one side, while on the other all are excluded by the extended inferior prefrontals and postfrontals; three pairs of large chin-shields, anterior longer than broad and in contact with the symphysial. Scales in 15 rows, smooth; three rows of vertebrae slightly enlarged. Ventrals 180; anal entire; subcaudals 60.

Color.—brown above, with vertical blackish bars on the sides; a black line from eye extending along nape, which is connected with its fellow on the opposite side by a black line which curves forward so as to almost touch the parietals; another black line from the eye to the angle of the mouth; yellowish below with very scattered dots of blackish brown.

The maxillary teeth of the type are 5-6.

Table XLVII shows the detail of structure in a series of eleven Szechwan specimens, only one of which (No. 67815, Stejneger, 1925, p. 93) has been reported in the literature. In this series the middorsal scale row is not or only very slightly enlarged.

*Distribution*.—*A. chinensis* is known from Luluping, the type locality,

TABLE XLVII. LEPIDOSIS OF *AMBLYCEPHALUS CHINENSIS*

Locality	Sex	Upper Labials	Upper Labials Excluded from Orbit	Enlarged Lower Labial	Loreal	Loreal Entering Orbit	Upper Preocular	Anterior Temporals	Prefrontal Entering Orbit	Maxillary Teeth (one side)	Keeling of Scales	Ventrals	Subcaudals	U. S. Nat. Mus. Number
50 miles north-west of Kwanhsien.....	♂										middorsal rows weakly keeled	176	74	67815
Mt. Omei.....	♀		yes	much enlarged slightly enlarged	simple	no	present	2-2	yes	5	smooth	176	66	69935
near Washan....	♀	8-?	yes	moderately enlarged	simple	no	present	2-2	yes	6	middorsal rows weakly keeled	177	62	69925
Chouchiakou....	♀		yes	much enlarged	simple	yes	absent	2-2	yes	5	middorsal rows very faintly keeled	175	72	76883
Chouchiakou....	♀		yes ?	much enlarged ?	simple ?	no ?	present ?	2-2 ?	yes ?	5	smooth	176	73	79891
Chouchiakou....	♀		yes	slightly enlarged	simple	no	present	2-2	yes	6	smooth	179	72	81505
Chouchiakou....	♀		yes	moderately enlarged	simple	no	present	2-2	yes no	5	smooth	176	69	81506
Huangchiakou...	♂	7-7	no yes	moderately enlarged	simple	yes no	present	2-2	yes	6	middorsal rows weakly keeled	179	74	73840
Huangchiakou...	♀		yes	much enlarged	simple	no	present	2-2	yes	?	very faintly keeled	176	71	73841
Yunnan border south of Sūchow.....	♀		yes	slightly enlarged moderately enlarged	simple	no	present	2-2	yes	5	smooth	179	72	79347
Yunnan border south of Sūchow.....	♀		yes	moderately enlarged	simple extra small one above	no	present	2-2	yes	6	smooth	176	71	78774

which is situated east and a little south of Washan at about  $103^{\circ} 15'$  E. Longitude; and from the six other Szechwan localities given in Table XLVII.

*Habits and Habitat*.—This snake, like others of the genus, apparently inhabits mountains. The altitude of the type locality is 4250 feet (Pratt, 1892, p. 111), and the species has been taken as high as 6000 feet (U. S. Nat. Mus. No. 79347).

The type holds 4 well-developed eggs containing embryos still in the earliest stages of development.

*Material examined*.—I have seen the type, in the Museum of Comparative Zoölogy; and 11 specimens from Szechwan, in the U. S. National Museum (see accompanying table).

### 113. *Amblycephalus kuangtungensis* Vogt

Figure 72

*Amblycephalus kuangtungensis* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 141.—Mell, 1922, p. 125 (type localities, Suliukuan, Lofaoshan, Kwangtung, 500 meters, Lungtou, Kwangtung, 600 meters).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 460, fig. 16 (Chungan Hsien, Fukien).  
*Amblycephalus monticola kuangtungensis* Mell, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 326 (Yaoshan, Kwangsi).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 134 (Lohsiang, Kwangsi).  
*Amblycephalus monticola kuangtungensis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 217.

*Description*.—Upper labials 7, sometimes entering, sometimes excluded from orbit; loreal excluded from orbit; preoculars present; anterior temporals 2, rarely 1; posterior temporals 3; scales smooth, in 15 rows throughout, vertebral row enlarged or not; ventrals in males 182-185; females 183-188; subcaudals in males 83-88, females 72-77; total length in males 580 and 342, females 640, 568 and 492 mm. (Description based on five specimens from Chungan Hsien.)

The maxillary counts in four of the Chungan Hsien specimens are 4-6, 5-6, 6-6 and 6-6 (7). The teeth cannot be counted in the fifth. Fan (1931, p. 135) gives the ventral and subcaudal counts of four males and three females from Lohsiang as follows: ventrals in males 184-188, females 185-194; subcaudals in males 88-93, females 81-89.

A translation of the original description based almost entirely on Berlin Museum No. 27661, a male, follows:

The rostral is somewhat broader than high, the internasals one-third shorter than the prefrontals, the longitudinal sutures of these pairs of scales are equal. The prefrontals reach the eye, which is surrounded by a small preocular in front, a long, narrow subocular and a small postocular. The frontal is hexagonal and is one and a half times as long as broad, as long as the parietals. The supraoculars are small, the small loreal does not reach the eye. Temporals 2 + 3, 7 supralabials, 7-8 sublabials and three pairs of submentals. The scales are smooth and disposed in 15 rows; the vertebral row is enlarged. Ventrals 180-188, subcaudals 78, anal undivided.

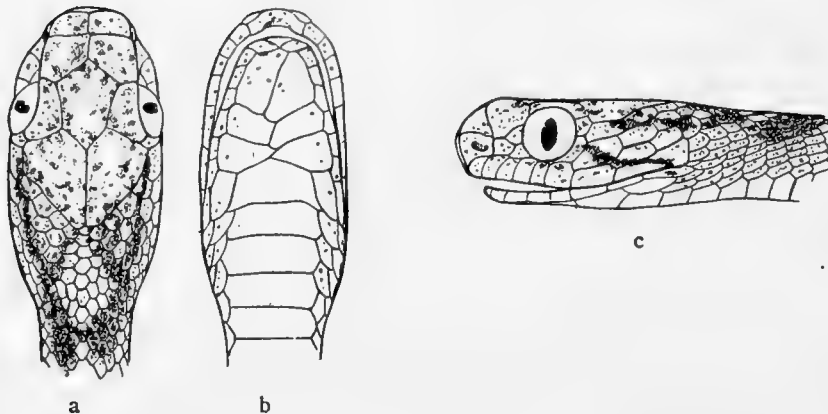


FIG. 72. *Amblycephalus kuangtungensis*.  $\times 4$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 34600 from Chungan Hsien, Fukien.

The color of the dorsal surface is brown, the head is speckled with numerous black dots. From the eye a black stripe extends along the parietal edge to the end of the parietals, a second fine, brown, interrupted stripe from the eye to the angle of the mouth. On the back two rows of alternating dorsolateral spots form a zig-zag line. The ventral surface is light brown with isolated brown dots. Total length 43.5 cm.; tail 10.5 cm.

The hemipenis extends to the ninth to tenth subcaudal plates and is forked opposite the fifth. It is entirely devoid of spines, but calyculate from a point about opposite the forking to the end of the organ. The calyces are large and relatively uniform in size but without scalloped edges. Proximal to the calyculate region, the hemipenis, save for a short, smooth area at its very base, is beset with a mixture of irregular longitudinal ridges and papilla-like processes. The lips of the sulcus are moderately conspicuous. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—*A. kuangtungensis* is known only from Chungan Hsien in Fukien; Lofaoshan and Lungtou in Kwangtung; and Lohsiang in Kwangsi.

*Habits and Habitat*.—I found this snake only in the high mountains about Kuatun (1929, p. 461), while Mell (1922, p. 125) secured it at altitudes of 500 and 600 meters in Kwangtung.

On August 23, four white eggs were brought in at Kuatun. The eggs, one of which measured 25 x 15 mm., contained advanced, pigmented embryos. The embryos measure from 156 to 166 mm. in total length (Pope, 1929, l.c.) and close examination reveals an egg-tooth on each.

*A. kuangtungensis*, when suddenly surprised, sometimes falls to the ground to remain in a semi-rigid condition suggesting a decayed twig (Mell, 1929, p. 234). *Haplopeltura boa*, an amblycephalid of the East Indies, exhibits the same interesting behavior (Taylor, 1922, p. 282). *A. kuangtungensis* does not attempt to bite or defend itself in any way when handled (Pope, 1929, p. 463).



*Material examined*.—I have seen No. 27661 and 2 additional Kwangtung specimens, in the Berlin Museum; and 5 from Chungan Hsien, in the American Museum.

*Remarks*.—It is possible that the Chungan Hsien material should be separated subspecifically from that of more southern origin (Kwangtung and Kwangsi).

114. *Amblycephalus moellendorffi* (Boettger)

Plate XXII, B, C, D, E, F and G

*Pareas Moellendorffi* Boettger, 1885, Ber. Offenbach. Ver. Naturk., XXIV-XXV, p. 125 ("Ad urbem Canton nec non in regno Siam." No. 9443, 1a from "Süd-China" designated by him, 1898, p. viii, as type; 1898, p. 128, this specimen listed from Lofaoshan, which is therefore the true type locality).—Cope, 1895, Proc. Acad. Nat. Sci. Phila., XLVI, p. 424 (Hainan; hemipenis; anatomy).

*Amblycephalus moellendorffi* Schlater, 1891, List Snakes Ind. Mus., p. 67 (Tenasserim).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 457 (Hainan).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 132 (Lohsiang, Kwangsi).

*Amblycephalus moellendorffi* Boettger, 1898, Kat. Rept. Mus. Senckenberg, II, p. viii (No. 9443, 1a designated as type; p. 128, type listed from Lofaoshan, Kwangtung, and additional material listed from Hongkong and Siam).

*Description*.—Upper labials 7, rarely 6, excluded from orbit; loreal excluded from orbit; preoculars present; scales in 15 rows throughout, smooth, vertebral row not enlarged; ventrals in males 139-142, females 147-150; subcaudals in males 52-58, females 41-43; total length of five males 364, 356, 351, 306 and 281 mm. (Description based on seven specimens from Hainan.)

The maxillary teeth in five specimens of the above series are 4-4; 4-? in two; 4-5; and 3(+)-3(+). In *moellendorffi*, the characteristic arrangement of the temporals is as follows: A narrow elongate scale, rarely divided, lies along the outer side of the parietal, thus occupying the usual position of the upper anterior and posterior temporals. A single lower anterior temporal, also in contact with the band-like postocular, separates this elongate temporal from the sixth upper labial.

The ventral and subcaudal counts of Fan's (1931, p. 134) Lohsiang series are: ventrals in eight males 136-143, in five females 143-153; subcaudals in eight males 51-57, in five females 35-40.

Small tubercles are present on the chin-shields of adult males.

A translation of the original description follows:

Differs from *P. carinatus* (Schleg.) [*Amblycephalus carinatus*] in the middle row of smooth scales not enlarged, the frontal little longer than broad, the small supraoculars, the parietals much longer than the frontal. Frenal longer than high, orbit surrounded below and posteriorly by a ring of confluent scales excluding the supralabials; a single preocular. Supralabials 7, of which the posterior two are much lower than the anterior. Very narrow temporals, 2 + 3. Three pairs of broad chin-shields. Sq. 15; G. o, V. 150, A. 1, Sc. 37/37.

Fuscous gray, ornamented above with numerous (40-45), more or less distinct, interrupted, black transverse bands spotted with white; below, yellow, irregularly spotted with

grayish-black, especially on the sides of the ventrals. Labials yellow, with fuscous gray sutures.

The hemipenis of *moellendorffi* has been described (1895, p. 424) and figured (1895, Pl. xv, fig. 12) by Cope. His figure is good save that the papilla-like structures of the middle third are entirely too conventionalized in size and arrangement.

*Distribution*.—This species is known in China only from Lofaoshan in Kwangtung; Lohsiang in Kwangsi; and Hainan.

The general distribution of *moellendorffi* is somewhat problematic but it seems to range rather widely over the peninsula of southeastern Asia (Wall, 1922, p. 24, and Smith, 1930, p. 88). I believe that it is often confused with *macularius* and allied forms.

*Habits and Habitat*.—Wall (1903, p. 97) found this snake common on Hongkong where he collected ten specimens "in low jungle on the slopes of the Peak." Smith (1923, pp. 197 and 204) secured it near the Wuchih Mts. of Hainan, 450-600 meters above sea-level. These as well as other records indicate that it is essentially a mountain snake, but its presence at Nodoa, where a specimen was caught in the Mission hospital, proves that it also occurs in open rolling country of low altitude. It was not common about Nodoa, however.

The stomach of a Hainan specimen (American Museum No. 27771) contained remains of a land snail.

*Bungarus multicinctus* may be numbered among the enemies of *moellendorffi* because a half-digested *moellendorffi* was taken from the stomach of a Hainan krait in the American Museum.

A female secured at Nodoa the third week of July appeared to be gravid but escaped before her condition had been more positively determined. A Lofaoshan specimen in the Senckenbergisches Museum, Frankfort, contains 2 well-developed, very elongate eggs, each about 25 mm. long.

A Nodoa example when handled exhibited no defensive behavior other than an effort to escape.

*Material examined*.—I have seen the following specimens from China: 7 from Hainan, in the American Museum; 1 from Lohsiang, in the Museum of Comparative Zoölogy; and 1 from the same locality in the U. S. National Museum; the type and another specimen from Lofaoshan, 2 from Hongkong and 2 from an undetermined locality, in the Senckenbergisches Museum, Frankfort.

*Remarks*.—Although Boettger states under his original description that the latter is based on a specimen from Siam, his statement is apparently erroneous, because the ventral and subcaudal counts in his description exactly agree with those of the specimen from "Süd-China" (Lofaoshan) which he later (1898,

p. viii) designated as type. Further evidence of his mistake is shown by the presence of well-preserved Canton region material in the collection of the Senckenbergisches Museum, although Boettger specifically stated that his Chinese specimens were badly dried up.

Dr. Mertens has very kindly assisted me in this problem (1933).

115. *Amblycephalus niger* Pope

Figure 73

*Amblycephalus chinensis* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 540 (part: Yunnanfu).

*Amblycephalus niger* Pope, 1928, Amer. Mus. Novitates, No. 325, p. 4 (type locality, Yunnanfu); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 461, fig. 17 (amplified description of type).

Description:—The original description of the type specimen, a male, follows:

Rostral as broad as deep; internasals in contact with loreal and half as large as prefrontals which enter the orbit; frontal, without its posterior projection, about as broad as deep, much shorter than, but about as wide as parietals which are as long as their distance from tip of snout. Loreal widely separated from eye by a distinct preocular and enlarged end of a subocular; a long, narrow scale separates eye from upper labials; anterior temporals 2, separated from eye by narrow scale below, wider one above; posterior temporals 3-3. Upper labials 7-7; lower, 7-7, first pair narrowly in contact behind mental; first 4 in contact with anterior chin-shields which are longer than broad; second pair slightly broader than long, third much broader than long; diameter of eye equals half interorbital space. Scales in 15 rows, vertebral row not enlarged. Ventrals 165; subcaudals 64; anal entire. Total length 502 mm., 0.22 occupied by tail.

The solid black of the top of the head extends down about to the loreal and lower anterior temporal where it begins to break into profuse spots which in turn become less profuse until, on the upper labials, they are sparse. On the lower labials and chin-shields the spots are reduced to a little scattered speckling. The neck and back are black but the black is broken on the sides by very irregular, light areas extending upward from the light ventrals, and suggesting the remnants of bands that have all but disappeared. Toward the tail these light areas are much more marked than they are anteriorly. The belly is light except for very irregular, sparse mottling mostly in the form of spots or narrow intrusions of the black of the dorsum. The tail is uniformly black with a little light mottling on the first 10 to 12 subcaudals.

The type was described as a female with 17 rows of scales. Both of these errors have been corrected above. Seven rows of scales are keeled at midbody.

The maxillary teeth are 6-7 in the type.

The hemipenis is spineless, extends to the ninth subcaudal plate and is forked opposite the fourth. Along the entire basal section as far as the point of forking, are numerous prominent but short longitudinal folds and papilla-shaped processes. These rapidly give way to large smooth-edged calyces that continue with little change in size to the extremity of the organ. The lips of the sulcus are not conspicuous.

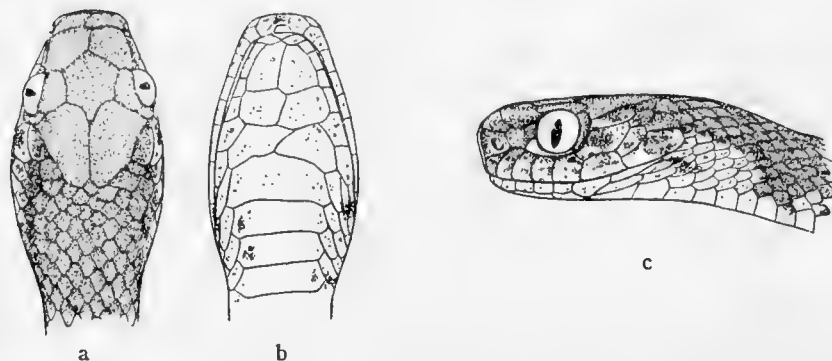


FIG. 73. *Amblycephalus niger*. Type.  $\times 4$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head.

*Distribution*.—*A. niger* is known only from the type specimen secured at Yunnanfu by John Graham.

*Habits and Habitat*.—This species is very probably the form prevalent on the Yunnan plateau.

#### 116. *Amblycephalus stanleyi* Boulenger

Figure 74

*Amblycephalus stanleyi* Boulenger, 1914, Ann. Mag. Nat. Hist., (8) XIV, p. 484 (type locality given as N. W. Fukien but the type actually came from Kuatun).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 462, fig. 18 (Chungan Hsien, Fukien).

*Amblycephalus sinensis* Stanley, 1916, Journ. N.-China Br. Roy. Asiat. Soc., (N.S.) XLVII, p. 83, Pl. (type locality, Kuatun hills, Fukien).

*Amblycephalus (formosensis) stanleyi* Mell, 1931, Lingnan Sci. Journ., VIII, p. 217.

*Description*.—Upper labials 7, rarely 8, excluded from orbit; loreal enters orbit; preoculars absent; anterior temporals 1 or 2; posterior temporals 3, occasionally 2, very rarely 1; scales in 15 rows throughout, 5 to 7 feebly keeled, vertebral row not enlarged; ventrals in males 151-160, females 157-160; subcaudals in males 58-60, females 48-53; total length in males 468, 296, 236 and 216 mm., females 375, 224, 215 and 189 mm. (Description based on eight specimens from Chungan Hsien.)

Stanley (1916, p. 83) gives the maxillary tooth count as 6, but examination of the Chungan Hsien series shows that the number varies from 4 to 6, with counts of individual specimens as follows: 4-4 in two, 4-? in one, 5-5 in two, 5-6 in one and 6-6 in two. The head pattern in this series is remarkably constant.

The original description of the type specimen, a male, follows:

Rostral slightly broader than deep, scarcely visible from above; internasals much shorter than the præfrontals, latter entering the eye; frontal hexagonal, once and a half as long as broad, longer than its distance from the end of the snout, shorter than the parietals; loreal longer than deep, entering the eye; no præocular; one postocular and two suboculars,

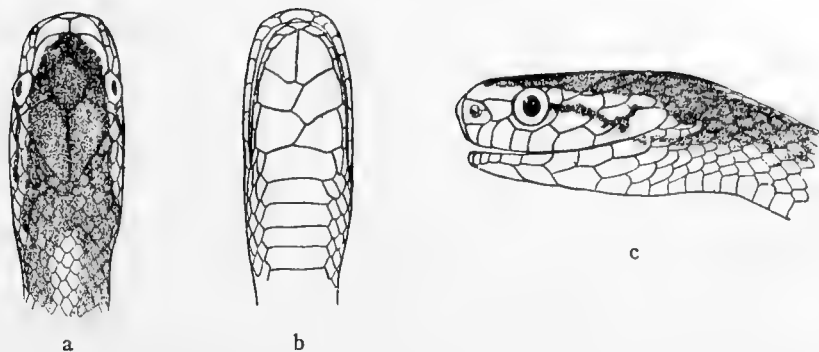


FIG. 74. *Amblycephalus stanleyi*.  $\times 4$ . a. Dorsal view of head. b. Ventral view of head. c. Lateral view of head. A.M.N.H. No. 34601 from Chungan Hsien, Fukien.

separating the eye from the upper labials; temporals  $2 + 3$ , seven upper labials, last very long; first lower labial forming a short suture with its fellow behind the symphyseal; three pairs of large chin-shields, the first longer than broad. Body compressed. Scales in 15 rows, dorsals (5 or 7 rows) feebly keeled. Ventrals 155; anal entire; subcaudals 57. Pale buff above, yellowish white beneath; a large black blotch on the upper surface of the head, from behind the internasal shields to the nape, where it divides into two longitudinal bands; more or less regular transverse series of black spots on the body, some forming interrupted cross-bands; a black streak on each side of the head, from the eye to the nuchal band; lower parts with black dots. Total length 440 mm.; tail 95.

The hemipenis extends to the seventeenth subcaudal plate and is forked opposite the sixth. It is calyculate and devoid of spines. The calyces arise a short distance beyond the point of forking, and persist nearly to the tip of the organ. They are large and nearly uniform save for a distinct reduction in size distally. Their unusually loose walls are not scalloped but have sinuous edges. The lips of the sulcus are prominent proximally, inconspicuous distally, and calyculate in the calyculate region. (Description based on a specimen from Chungan Hsien.)

*Distribution*.—*A. stanleyi* has been collected only in the mountains about Kuatun and Sanchiang, Fukien.

*Habits and Habitat*.—I found this species only in the high Kuatun-Sanchiang mountains. All the specimens handled were docile and neither bit nor showed any defensive behavior whatsoever (Pope, 1929, p. 463).

The stomachs of two Chungan Hsien specimens held each a slug, probably of the family Limacidae, while an unidentifiable slug was found in another individual, No. 29943.

American Museum No. 29943 was retrieved from the stomach of a *Dinodon flavozonatum*.

I (1929, l.c.) secured the following data on the breeding habits of *stanleyi*: On August 20 six white eggs were bought at Kuatun (No. 34610). They evidently belonged

to one batch and their greater diameter ranged from 24 to 26 mm., the lesser from 12 to 13.2. On the 25th another lot containing 4 white eggs was secured. These (No. 34611) ranged from 22 to 26.2 mm. in greater, and from 14 to 15.5 mm. in lesser diameter. These eggs were said to have been dug up by men weeding the high Kuatun tea fields. There is little reason to doubt the report. Probably the snakes inhabit the scrubby, bushy, growth of the Kuatun valley. No. 34492, two well-developed but unpigmented embryos from a lot of 12 eggs, is dated August 16 and 19.

Egg-teeth are evident in all of these three lots of embryos. The six eggs, American Museum No. 34610, contained well-pigmented embryos remarkably uniform in size, measuring respectively 136, 136, 135, 135, 135 and 132 mm. in total length.

*Material examined*:—I have seen the type, in the British Museum; and 8 specimens from Chungan Hsien, in the American Museum.

*Remarks*:—Stanley's (1914, p. 31) "*Amblycephalus* sp. n.?" probably refers to the present form.

*A. stanleyi* was associated with *formosensis* by Mell (1931, p. 217) but on what grounds I do not know. The unusually long hemipenis of *stanleyi* must not be forgotten when questions of relationships are under consideration.

The specimen mentioned above (American Museum No. 29943) that had been devoured is interesting in being an hermaphrodite. The hemipenes are well enough developed to exhibit their characteristic structure and, indeed, it was solely by examination of these organs that I was enabled to identify this headless and partly digested specimen previously referred to as "*Holarchus* (species?)" (Pope, 1929, p. 453), while the oviducts contain six fully formed and apparently normal eggs. One of these measures 19 x 8 mm. and is equaled in size by at least two others. Gross examination fails to reveal any sign of embryo in one egg dissected.

#### 117. *Amblycephalus tonkinensis* (Angel)

Figure 75

*Eberhardtia tonkinensis* Angel, 1920, Bull. Mus. Hist. Nat., Paris, XXVI, p. 291, figs. 1-3 (type locality, Laokay, Tongking); 1929, Bull. Mus. Hist. Nat., Paris, (2) I, p. 80 (Laos).

*Amblycephalus carinatus hainanus* Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 204 (type locality, Wuchih Mts., Hainan, 1300 meters).

*Description*:—Upper labials 8, excluded from orbit; loreal excluded from orbit; preoculars present; anterior temporals 2; posterior temporals 3; scales smooth, in 15 rows throughout, vertebral row enlarged; ventrals 194; subcaudals 93. (Description based on the type of *A. carinatus hainanus*, a male.)

Smith (1923, p. 204) describes a female paratype of *hainanus* from the Wuchih Mountains as having 191 ventrals and 82 subcaudals, while these counts in a male and female from Laos (Angel, 1929, p. 80) are 191, 93, and 186,

80, respectively. The Laos examples agree very well with the type of *tonkinensis* (Angel, 1929, l.c.).

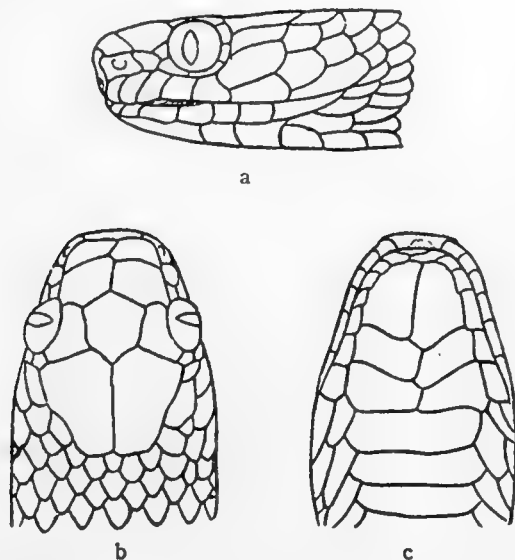


FIG. 75. *Amblycephalus tonkinensis*. Type. a. Lateral view of head. b. Dorsal view of head. c. Ventral view of head. (From Angel.)

A translation of the original description, based on the type specimen, a female, follows:

Body elongated, strongly compressed, the tail comprising a fourth of the total length. Eye moderate; its diameter, carried forward, reaches to the anterior side of the nostril. Rostral one and a half times as broad as high, slightly visible from above. Internasals half as long as the prefrontals. Frontal longer than broad; its breadth is equal to the distance from its anterior angle to the tip of the snout. Parietals one and a third times as long as the frontal. Nasal entire. Loreal longer than high, separated from the eye by two preoculars. Two postoculars, and one subocular separating the eye clearly from the labials. Temporals  $2 + 2$ , the lower ones considerably larger than the upper. Seven upper labials, the seventh very long. The two anterior lower labials are in contact behind the symphysis. Three pairs of chinshields, the anterior pair longer than broad. Scales smooth, without apical pits, in 15 rows, the vertebral row slightly enlarged. Ventrals: 194. Anal entire. Subcaudals: 88.

Above and below, the ground color is light yellowish, faintly roseate. The dorsal and lateral areas are finely speckled with very small brown points, everywhere equally distributed. On the head plates these points are enlarged into small spots. Two parallel brown lines, starting from the posterior part of the supraocular plates, border the head and terminate in front of the neck. Two other bands on the nape form a  $\Delta$ , whose point begins on the posterior part of the parietals. A number of larger points form the outline of a band passing from the eye to the corner of the mouth. On the back and tail irregular, transverse, brown bands end on the border of the ventrals and nowhere have a greater width than two scale lengths. These bands sometimes alternate from one side to the other, sometimes unite in the vertebral region. Furthermore, their dark color is due rather to the brown edging of the scales comprising them, than to the center itself of the scales, which is lighter. The ventral

and subcaudal surfaces are sprinkled with brown dots larger but much less numerous than on the back and sides. Total length: 520 mm.; tail: 130 mm.

*Distribution*.—As here conceived, *tonkinensis* is known from Tongking (Laokay, the type locality), Laos, and Hainan.

It is more than likely that Parker's (1925, p. 305) *A. hamptoni* from Ngoi-Tio, Tongking, 4500-6500 feet, actually represents *tonkinensis*. The same may be said of the specimen in the British Museum from Chapa (above 5000 feet) reported by Smith (1930, p. 681) as *Pareas hamptoni*. Ngoi-Tio and Chapa are very near Laokay (Delacour, 1930, p. 564).

*Habits and Habitat*.—The locality records for the most part indicate that *tonkinensis* is an inhabitant of mountains at considerable altitudes.

*Material examined*.—I have seen the type, and 2 examples from Laos, in the Paris Museum; and the type of *hainanus* in the British Museum. I have also examined the Ngoi-Tio and Chapa specimens identified as *hamptoni*, in the British Museum.

*Remarks*.—The accompanying summary of data (Table XLVIII) on the maxillary dentition of various species of *Amblycephalus* should suffice to show that, in the light of the latest knowledge, Angel's new genus, *Eberhardtia*, based on the number of maxillary teeth (9 in the new genus compared to 5-6 in *Amblycephalus*, Angel, 1920, p. 291), cannot stand.

TABLE XLVIII. MAXILLARY COUNTS OF SPECIES OF *AMBLYCEPHALUS*

<i>Species</i>	<i>Maxillary Count</i>	<i>Material or Reference</i>
<i>moellendorffi</i> .....	4-5	5 Hainan specimens in the American Museum
<i>stanleyi</i> .....	4-6	8 Chungan Hsien specimens in the American Museum
<i>kuangtungensis</i> .....	4-6	5 Chungan Hsien specimens in the American Museum
<i>carinatus</i> .....	5	Wall, 1922, p. 26
<i>chinensis</i> .....	5-6	9 Szechwan specimens in the U. S. Nat. Mus. (counts taken by me on one side of each)
<i>monticola</i> .....	5-7	Wall, 1922, p. 23
<i>niger</i> .....	6-7	type
<i>formosensis</i> .....	7-8	3 Formosan specimens examined by me
<i>tonkinensis</i> .....	(7)8-9	type and 2 Laos specimens examined by me



I count 7 teeth on the maxilla of the type of *hainanus*. Wall's (1922, p. 25) data on *macularius* indicate that it has as high a count as 8.

Although probably only a direct comparison of the hemipenes of *tonkinensis* and *hainanus* will establish their relationship beyond any doubt, I believe that the available structural data, taken together with the geographical probability, constitute good reason for placing *hainanus* in the synonymy of *tonkinensis*. It should be noted that Smith (1930, p. 88) has already synonymized his *hainanus* under *A. carinatus berdmorei*. I cannot agree that his Hainan material belongs to any form of *carinatus*. On p. 89, Smith, apparently on the strength of a British Museum specimen from the Bowring collection, includes Hongkong in the range of *carinatus*. As I have stated elsewhere and Boettger (1888, p. 145) long ago remarked, several of Bowring's Hongkong records are obviously based on material from Java. There is little doubt that *carinatus* has no place in the Chinese fauna.

118. *Amblycephalus yunnanensis* Vogt

*Amblycephalus yunnanensis* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 142.—Mell, 1922, p. 125 (type locality, Tali region, Yunnan, 2200 meters).

*Amblycephalus monticola yunnanensis* Mell, 1931, Lingnan Sci. Journ., VIII, p. 216.

*Description*.—A translation of the original description based almost entirely on cotype number 27660, a female, follows:

The rostral is somewhat broader than high, internasals only half as broad as the prefrontals. The latter touch the eye, which is surrounded by two small, triangular preoculars, a narrow subocular and 1-2 postoculars. The point of the large loreal touches the eye. The supraoculars are half as broad as the frontal, which is somewhat longer than broad and shorter than the parietals. Temporals 2 + 2 or 2 + 3, the lower anterior the largest. Of the 7 supralabials the 7th is the largest, the first four narrow, higher than broad. Seven sublabials and 3 pairs of submentals. Scales in 15 rows, the vertebral row slightly enlarged; six dorsal rows lightly keeled, the rest smooth. Ventrals 174. Subcaudals 65, anal undivided.

The top of the head is dark brown, its sides light brown with fine, brown dots, unstriped. Two dark brown stripes pass from the parietals to the first of the numerous dark brown crossbands of the back. The lighter interspaces are equal in width to the dark crossbands. The ventral surface is light brown with fine, brown dots, which become more profuse on the posterior portion. Total length 48, tail 9.5 cm. Total length 51, tail 10 cm.

I have determined the ventral count of No. 27660 more accurately as 171.

Upper labials 6 or 7, excluded from orbit; tip of loreal entering orbit; preoculars present; anterior temporals 2; scales in 15 rows throughout, several feebly keeled, vertebral row slightly enlarged; ventrals 176; subcaudals 64. (Description based on the second cotype, also a female.)

No lower labial is greatly enlarged in either of the cotypes. Mell (1931, p. 216) gives the maximum number of ventrals as 196 but this figure should be 176. He was apparently misled by a label attached to the second cotype bearing the figure 196. I have recounted the ventrals of both specimens.

*Distribution*.—*A. yunnanensis* is known only from the region of Tali, Yunnan.

*Habits and Habitat*.—Mell secured the only known specimens of this species at an altitude of 2200 meters.

*Material examined*.—I have seen the two cotypes in the Berlin Museum.

#### Family VIPERIDÆ

##### KEY FOR IDENTIFICATION OF CHINESE GENERA

- I. Head covered above with a few large, paired shields; scales of body smooth, in 17 rows..... *Azemiops*, p. 382
- II. Head covered above with numerous, small scales; scales of body keeled, in more than 17 rows..... *Vipera*, p. 384

#### Genus *Azemiops* Boulenger

*Azemiops* Boulenger, 1888, Ann. Mus. Civ. Stor. Nat. Genova, (2) VI, p. 602.

This monotypic genus is of special interest because its single species is possibly the most primitive viper known. In addition to it, only two other genera of vipers, *Causus* and *Atractaspis*, both of Africa, have the usual large head plates, low scale count, and general habitus of most colubrid snakes. *Atractaspis*, however, with its enormous fangs, is highly specialized, so *Causus* and *Azemiops* are left as the most primitive types.

#### OBVIOUS RECOGNITION CHARACTERS

Generally blackish above with about 15 narrow, white cross-bands often interrupted middorsally, each scale with a light center; scales smooth, in 17-15 rows; not viper-like in appearance but with large, erectile fangs present in front part of mouth; no pit between eye and nostril.

#### 119. *Azemiops feae* Boulenger

##### Plate XXIII, A, B and C

*Azemiops feae* Boulenger, 1888, Ann. Mus. Civ. Stor. Nat. Genova, (2) VI, p. 603, Pl. VII (type locality, Kachin Hills, Burma).—Chang, 1932, Contr. Biol. Lab. Sci. Soc. China, (Zool. Series) VIII, p. 68, fig. 23 (Yenchinghsi of Opian Hsien, Szechwan, 1040 meters).

*Description*.—The original description of the type specimen, a male, follows:

Head elliptical, snout short and broad; rostral moderate, broader than deep; internasals and prefrontals subequal in length; frontal a little broader than long, nearly thrice as broad as the supraocular; parietals as long as their distance from the end of the snout, pointed posteriorly, bordered laterally by the anterior temporal and three scales; loreal small, pentagonal, deep as long; two preoculars on the right side, three on the left (the former number being apparently the normal); two subequal postoculars; two large superposed anterior temporals, the upper alone in contact with the postoculars; six upper labials, third entering the orbit, first and second smallest, fourth and fifth largest; seven lower labials, first large and forming a

long suture with its fellow, second small; a pair of short chin-shields, the suture between them shorter than that between the first labials, separated from the ventral shields by three transverse series of scales. Dorsal scales equal, smooth, in 17 longitudinal series. Ventrals 180; subcaudals 42 pairs. Blackish above, the scales being dark grey in the centre and black on the borders, with fifteen transverse white bands, one scale wide, some of which are disconnected in the middle and alternate with those on the other side; upper surface of head, from the praefrontals, black, with a yellow median line, which is very narrow anteriorly and widens posteriorly, ending on the neck on the eleventh transverse series of scales; end of snout and sides of head yellow; a blackish streak from below the eye to the lower border of the fourth upper labial; another from the postoculars to the upper border of the sixth labial. Lower parts olive grey, with some small lighter spots; chin and throat variegated with yellow. Total length 610 millim.; tail 90.

The type agrees remarkably well with Chang's specimen from Yenchinghsi. Chang did not sex his snake but gives the ventral count as 186, the subcaudal as 53; total length 675 mm. Though only two specimens have been recorded in the literature, there is a male example in Munich from Pingsiang, Kiangsi, collected by Kreyenberg and examined for me by K. P. Schmidt. It has 170 ventrals and 47 subcaudals. I understand that Dr. Wolterstorff has still another Pingsiang specimen and there is a male specimen from Chouchiakou, Szechwan, 2000-4500 feet altitude, in the U. S. National Museum (No. 84363) with 189 ventrals, 53 subcaudals and scales 17-15.

The hemipenis of the type is bifurcate opposite the fourth to fifth subcaudal plate but extends to the tenth to eleventh; the sulcus is single in each fork. The organ is longitudinally folded proximal to the bifurcation but, distal to the point of forking, it is first spinous and then calyculate, the spinous area being about as extensive as the calyculate region. The line of demarcation between the spinous and calyculate sections extends straight across the organ but is only moderately distinct. The spines are numerous and very variable in length, while the calyces have scalloped edges and are uniformly prominent throughout. The lips of the sulcus are prominent and bear small spines in the spinous area but are calyculate in the calyculate region.

*Distribution*.—*A. feae* is known only from Yenchinghsi and Chouchiakou, in Szechwan; Pingsiang in Kiangsi; and the type locality in Upper Burma. This snake was apparently discovered on the edge of its range. Its re-appearance in China is of great interest and importance.

*Habits and Habitat*.—In spite of its presence at Pingsiang, this true viper is probably an inhabitant of mountainous country. The Chouchiakou example was collected between 2000 and 4500 feet, the one from Yenchinghsi at 1040 meters or 3412 feet.

*Material examined*.—I have seen the type; and U. S. Nat. Mus. No. 84363 from Chouchiakou.

Genus *Vipera* Laurenti

The species of this genus are widely distributed in Africa, Europe and western Asia, while one (*V. berus*) extends its range eastward across northern Asia to the Pacific coast. The species dealt with below is the only one that reaches the Malay Archipelago or is at all extensively distributed in southern Asia.

## OBVIOUS RECOGNITION CHARACTERS FOR THE CHINESE SUBSPECIES

Color brown above with three longitudinal rows of large, dark blotches; head distinct from neck, long, narrow anteriorly, broad posteriorly, scales keeled; typically viperine in both appearance and behavior and with large erectile fangs present in front part of mouth; no pit between eye and nostril.

120. *Vipera russelii siamensis* Smith

## Plate XXII, H

*Vipera russelii siamensis* Smith, 1917, Journ. Nat. Hist. Soc. Siam, II, p. 223, Pl. (type locality, Sam Kok, central Siam); 1923, VI, p. 62 (central and eastern Siam and eastwards as far as Formosa).

*Vipera russelii* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 125 (Wuyung and Namkong, Kwangtung) (not of Shaw, 1802).

*Description*.—A geographical race differing from the typical form in possessing an additional series of small, elongated spots on either side of the body, interposed between the usual three longitudinal rows of large ones. The spots composing these two extra rows are considerably smaller in size than those forming the normal dorsal and lateral chains, are black in color, with or without a lighter centre, and edged entirely, or in part, with white. In other characters this form does not differ from the typical one. . . . Scales in 29 rows in mid-body; ventrals 163; subcaudals 44. (Quoted from Smith, 1917, p. 223.)

The total length of the largest example measured by Smith is 1320 mm. (1923, p. 62).

The hemipenis of a specimen of the typical form (*V. russelii russelii*) without data may be described as follows (compare Wall, 1921, p. 510): The organ is spinous proximally, calyculate distally, and forked almost to the base. The calyces and large spines are about equal in extent, and the line of demarcation between them fairly abrupt. There are numerous, minute spines proximal to, and intermixed with, the large conspicuous spines. The edges of the more proximal calyces are shallowly scalloped and finely pointed, but near the tip, the calyces have only slightly scalloped or straight edges.

*Distribution*.—This viper is known only from Kwangtung (Wuyung and Namkong) in China.

The distribution of *Vipera russelii* is very sporadic. The typical form ranges from Ceylon northward over India to Sind, the Western Himalayas, and the Ganges basin (Wall, 1928, p. 60); *siamensis* is known from Burma, Siam

north of Bangkok (Smith, 1917, l.c., and 1923, l.c.), and Kwangtung; *limitis* from Komodo and Endeh Id. near Flores (Mertens, 1930, p. 328); and *formosensis* from Formosa (Maki, 1931, p. 197). This discontinuous range is not easily explained as due to inconspicuousness or specialized habits because *russelii* is readily seen and often uncommonly abundant, as many as 471 specimens having been brought to one office for reward in a single day (Wall, 1928, l.c.).

*Habits and Habitat*.—Mell (1922, p. 125) found *siamensis* at low altitudes in southern Kwangtung, but Maki (1931, p. 198) states that *formosensis* inhabits mountains, while the typical form "is chiefly an inhabitant of the plains, but is common in some localities from 2000 to 4000 feet and has been met with at altitudes up to 6000 and 7000 feet" (Wall, 1928, l.c.). In recording a specimen as *russelii* from Mandalay, Wall (1925, p. 821) states that it is "A very common snake in the plains of Burma and universally distributed."

Smith (1915, p. 182) records feeding a captive specimen on mice.

Wall has given two excellent accounts of *russelii* in India (1907, pp. 1-17, and 1921, pp. 504-529). A few points of special interest have been abstracted from his later account as follows:

1. It avoids dense jungle but is otherwise to be found almost anywhere (p. 506).
2. It is sluggish but when aroused strikes vigorously and may even hold on for some time. It hisses a great deal when annoyed and the sides may heave noticeably. The younger examples are the most vicious (pp. 507 and 508).
3. In a wild state it feeds chiefly on small mammals, especially rats, but has been known to eat a lizard (*Calotes*) (p. 509).
4. It is ovoviviparous, frequently producing from 30 to 40 young at a time, but has been known to give birth to as many as 63 (pp. 510 and 512).

*Material examined*.—I have seen 2 examples from Kwangtung collected by Mell, in the Berlin Museum.

*Remarks*.—Although I am unable to prove it, I strongly suspect that the form of *russelii* common in Upper Burma, even to Myothit between Bhamo and the Yunnan border (Wall, 1928, l.c.), is *siamensis*. There is apparently a break in the range of *russelii* between the Ganges and Irrawaddy basins, for it is not known in the Brahmaputra valley, and it is logical to suppose that the color forms are separated by this hiatus.

Without doubt, *russelii* will be found in southern Yunnan.

The bite of *russelii* is frequently fatal to man (Wall, 1928, p. 61; see also pp. 102-114).

#### Family CROTALIDÆ

##### KEY FOR IDENTIFICATION OF CHINESE GENERA

- I. Head covered above with a few large, paired shields. . . . . *Agkistrodon*, p. 386
- II. Head covered above with numerous, small scales. . . . . *Trimeresurus*, p. 403

Lynn (1931, p. 97) has given an excellent description of the famous facial pit of the crotalid vipers and made, among other statements in his summary and conclusions, the following especially interesting ones concerning it:

The facial pit is a rather complex organ consisting of two chambers separated from each other by a thin sheet of tissue, the 'pit membrane.' The outer chamber is widely open and is in free communication with the air; the inner chamber communicates with the exterior by a small pore situated near the anterior border of the orbit. The cuticle which covers the body extends into this chamber and there presents a much-tuberculated appearance, the tuberculations being most pronounced in adult specimens. The 'pit membrane' is richly supplied with nerves derived from the ophthalmic and supramaxillary branches of the fifth cranial nerve.

In its structure the organ under consideration shows certain very striking resemblances to the chordotonal organ of insects, an organ which is known to be auditory in function. The pit organ, it would seem, is structurally well adapted to perform a similar function.

#### Genus *Agkistrodon* Beauvois

Three of the twelve species of this genus are found in North America, eight in Asia and one in eastern Europe and Asia. The theoretical center of generic distribution in Asia falls in western China, for a circle with a radius of approximately 750 miles and a center in northwestern Yunnan includes wholly (*strauchi* and *monticola*) or in part (*acutus*, *halys*, *himalayanus* and *rhodostoma*) the ranges of all but two (*hypnale* and *millardi*) of the Asiatic species. The range of *annamensis* is too imperfectly known for it to be included in the foregoing statement.

So many general and only partly correct statements about the reproduction of pit-vipers have been made that I consider it advisable to bring together certain definite data on this subject. These data, set forth in Table XLIX, show that ovoviviparity is the general rule and, moreover, indicate that no correlation between habitat preference or latitude of distribution and method of production of young can be found.

Little is known of the recently described *A. annamensis* Angel (1933, p. 278) save that its unique type was taken at an altitude of 30 meters in southern Annam on the threshold of a house.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Head broad and distinct from neck; top of head covered with a few, large, regular plates; viper-like in both appearance and behavior and with large, erectile fangs present in front part of mouth; a deep pit between eye and nostril.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Internasals and rostral produced to form a short, upturned appendage. ....

*acutus*, p. 387

## II. Internasals and rostral normal

## A. Scales in 21 or more rows at midbody

1. Internasals broader than long, often band-like; a yellowish stripe beginning on the uppermost postocular and extending rearward nearly always present..... *halys*, p. 390
2. Internasals longer than or as long as broad, never band-like; no yellowish stripe extending rearward from uppermost postocular..... *strauchi*, p. 400

B. Scales in 19 rows at midbody; no yellowish stripe extending rearward from uppermost postocular..... *monticola*, p. 398

TABLE XLIX. REPRODUCTION AND HABITAT PREFERENCES OF SPECIES OF *AGKISTRODON*

<i>Species</i>	<i>Reproduction</i>	<i>Habitat Preference</i>	<i>Mean Latitude of Range</i>
<i>mokasen</i> .....	ovoviviparous	mountains and plains	36° N.
<i>piscivorus</i> .....	ovoviviparous	plains; aquatic	32° N.
<i>bilineatus</i> .....		plains; aquatic	18° N.
<i>acutus</i> .....	oviparous	mountains	28° N.
<i>strauchi</i> .....	apparently ovoviviparous	plateau and mountains	31° N.
<i>monticola</i> .....	unknown	high mountains	27° N.
<i>halys</i> .....	ovoviviparous	mountains, plateaus and plains	44° N.
<i>himalayanus</i> .....	ovoviviparous	mountains	29° N.
<i>hypnale</i> .....	ovoviviparous	mountains and low country	13° N.
<i>millardi</i> .....	ovoviviparous	mountains	8° N.
<i>rhodostoma</i> .....	oviparous	mountains and plains	7° N.

121. *Agkistrodon acutus* (Guenther)

## Plate XXIII, D, E, F and G

*Halys acutus* Guenther, 1888, Ann. Mag. Nat. Hist., (6) I, p. 171, Pl. XII (type locality erroneously given as "mountains north of Kiukiang"; Pratt collector).—Pratt, 1892, Snows of Tibet, p. 5 (type locality, Wusüeh, Hupeh).

*Ancistrodon acutus* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 524 (Ichang, Hupeh).

*Description*.—Internasals and rostral produced to form a short appendage; 1 to 3 small scales between nasal and scale forming anterior border of pit; scales keeled, in 23 rows on the neck, 21, rarely 23 at midbody, and 17, rarely

19 before the vent; ventrals in eight males 157-165, in eight females 165-171; subcaudals in eight males 53-60, in eight females 52-55; 5 to 16 subcaudals undivided. (Description based on sixteen specimens from Chungan Hsien.)

The maximum length recorded for this snake is 1545 mm. (Maki, 1931, p. 202), and the largest Fukien specimen in the American Museum measures 1450 mm. The latter is a skin undoubtedly somewhat stretched. Maki gives the greatest length of Formosan males and females as 1130 and 1250 mm., respectively.

The rather marked ontogenetic color change was described by me (1929, p. 473) as follows:

Although the pattern remains generally the same, the complete change in intensity and comparative value of the varied shades of brown, gray, and black cause the adult to look very different from the young. The adults are darker but this darkening takes place to a greater degree in definite areas. The top of the head is light gray in the young, so the dark streak posterior to the eye is brought out in strong outline. Its lower edge, moreover, has a narrow light border. In the largest examples the top and upper side of the head are uniformly very dark, the streak from the eye having lost its light border and united with the darkened top of the head. The lateral triangles in the young are also narrowly light-bordered, but this border is lost in the general darkening brought on by age. Thus, the lighter young are more vividly marked than the darker adults.

The original description, based on three male specimens, follows:

This new species may be at once recognized by the upper part of the extremity of the snout being produced into a short, flexible, pointed lobe which projects from between the anterior frontal and the rostral shield. The anterior frontals are small, longer than broad; the posterior very large, intermediate in size between the anterior frontals and the occipitals. Eye surrounded by a ring of small orbitals, of which those in front are rather elongate; that below the eye is likewise long and crescent-shaped, separated by a small postocular from the superciliary shield. Seven upper labials, of which the second forms the anterior wall of the antorbital pit, the third and fourth being the largest. A series of three large temporal shields occupies the lower part of the temple, the space between this series and the occipital being covered by ordinary scales. Scales strongly keeled, the keels forming a high sharp ridge on the posterior part of the body. Each scale bears, besides the keel, on its extremity a pair of very small nodules; scales in twenty-one rows. Ventral shields 160; anal entire; subcaudals 60, of which the six or twenty anterior may be single. Extremity of the tail compressed, covered with comparatively large vertical scutes, and terminating in a long and compressed spine.

The colour of the upper parts is brown, each side of the body being ornamented with a series of large dark-coloured triangles, the point of each triangle meeting that of the other side in the median line of the back. Lower parts whitish, with a series of large rounded black spots on each side and smaller ones of irregular shape in the middle. The upper part of the head is uniform black; a sharp line, which runs from the eye along the middle of the temporal scutes to the angle of the mouth, dividing the black coloration of the upper parts from the white of the lower.

The hemipenis extends to the eleventh to twelfth subcaudal plates and is



forked opposite the fifth. It is smooth proximal to the point of forking, first spinous, and then calyculate distal to this point, the spinous and calyculate areas being about equal in extent. The spines, about fifty in number, are large and fairly uniform in size; the line of demarcation between them and the calyces is distinct but does not extend straight across the organ. The calyces are not reduced in size distally and have very shallowly scalloped or wavy margins. They are especially well developed opposite the sulcus at and near the tip of the organ. The lips of the sulcus are moderately prominent, almost devoid of spines in the spinous area and calyculate in the calyculate one. (Description based on a specimen from Shenchow.)

*Distribution*.—This snake, known only from China, Tongking and Formosa, has been recorded from the following Chinese localities:

Hupei: Ichang; Wusüeh.

Hunan: Shenchow.

Chekiang: Mokanshan.

Fukien: Chungan Hsien (including Kuatun).

Kwangtung: near the Hunan boundary.

Wall (1903, p. 98) writes of having seen a specimen in the Siccawei Museum that may have been collected in Szechwan. He also mentions additional examples labeled "Ou-Yuen," "Chowtung" and "Kien-té." The first of these I take to be Wuyuan in southern Anhwei, the second Chowtung in southern Fukien, while the last is stated by Wall to be in Anhwei but I fail to find it in any list or on any map. There is, however, a Chienteh in northern Hupei west of Kwanghwa.

Angel and Bourret have recently (1933, p. 140) recorded *acutus* from Chapa, northern Tongking, about 1500 meters altitude.

*Habits and Habitat*.—I found *acutus* abundant in the high, forested mountains about Sanchiang where it frequented boulder-strewn mountain sides and wild ravines (Pope, 1929, l.c.). Although one individual was taken in an open, cultivated valley, this pit-viper was usually discovered by day coiled neatly on a bed of dry leaves caught among boulders, and such a situation undoubtedly satisfies its desires.

In spite of a docile disposition (Boulenger, 1899, p. 166), this snake strikes and bites viciously when aroused by repeated annoyance. I have seen it handled with impunity while yet unalarmed.

One Chungan Hsien example disgorged a bird, another a rat, while a half-grown individual was found in the stomach of an *Elaphe carinata* (Pope, 1929, l.c.).

According to Maki (1931, l.c.), *acutus* lays about 20 eggs. A 1244 mm., Chungan Hsien female in the American Museum holds 26 well-developed eggs

(Pope, 1929, l.c.) one of which contains a pigmentless embryo 78 mm. long. An average egg from this clutch measures 21 x 35 mm.

*Material examined*.—I have seen the following material: the 3 cotypes, 1 specimen from Ichang and 2 from Kuatun, in the British Museum; 1 each from Mokanshan and Kuatun, in the U. S. National Museum; 1 from Formosa, in the Museum of Comparative Zoölogy; 32 from Chungan Hsien and 1 from Shenchow, in the American Museum:

*Remarks*.—Hara (1928) has studied the blood pictures produced by the venoms of *acutus* and four other Formosan snakes and concluded that the toxicoses resulting from their bites cannot be differentiated by a study of these blood pictures alone.

## 122. *Agkistrodon halys* (Pallas)

### Plate XXIV, A

*Coluber Halys* Pallas, 1776, *Reise verschied. Prov. Russ. Reichs*, III, p. 703 (no type locality given but, according to Strauch, 1873, p. 242, Pallas discovered *halys* "am oberen Jenissei, bei den Salzseen unweit des Lugaskoi Sawod"; see Pallas, *Zoographia Rosso-Asiatica*, p. 49, ed. 1831).

*Trigonocephalus blomhoffii* Boie, 1826, *Isis*, p. 214 (type locality, Japan).

*Trigonocephalus intermedius* Strauch, 1868, *Trudi Perv. Siezda Russkikh Yestestv.*, Zool., p. 295 (type localities, Amur, Khingan and "Island of Yezo."

*Agkistrodon blomhoffii brevicaudus* Stejneger, 1907, *Herp. Japan*, p. 463 (type locality, Fusan, Korea).

*Ancistrodon blomhoffii ussuriensis* Emelianov, 1929, *Snakes Far East. Dist.*, p. 123, figs. 38-41 (type locality not given).

*Ancistrodon halys stejnegeri* Rendahl, 1933, *Arkiv. Zool.*, Stockholm, XXV A, No. 8, p. 18, fig. 4 (type locality China).

*Description*.—Rostral somewhat broader than high, just visible from above; internasals much wider than long, considerably narrowed and produced backward laterally; internasal suture slightly less than half that of prefrontals; length of frontal equal to its distance from tip of snout, slightly longer than internasal and prefrontal sutures combined, shorter than parietals; upper labials 7-7, only the 3rd entering orbit, 3rd and 4th much deeper than 5th; preoculars 2-2, postoculars 2-3, the lowermost separating the 4th upper labial from the eye; anterior temporals 2-2; lower labials 10-10; chin-shields short, as long as their combined width; scales in 23 rows on the neck, 21 at midbody, and 17 before the vent; ventrals 143, subcaudals 41; length from snout to vent 497, tail 77 mm. Color light gray with a series of large, more or less alternating, darker gray blotches extending along either side of the dorsum, these blotches irregularly margined with black posteriorly and anteriorly; belly gray, very densely mottled with blackish gray, every second or third plate with a small black spot of irregular shape at either extremity; head light gray above, darker on the sides save for the white upper labials and a conspicuous, narrow, light stripe extending backward from the uppermost postocular and

TABLE L. LEPIDOSIS AND DIMENSIONS OF *AGKISTRODON HALYS* PRESERVED IN THE AMERICAN MUSEUM

Locality	Sex	No. of Specimens	Upper Labials	Scale Rows	Ventrals	Sub-caudals	Maximum Total Length in Millimeters	American Museum Number
Wanh sien . . . . .	♂	1	7	21-21-17	140	41	206	23489
Shenchow . . . . .	♂	1	7	21-21-17	141	36	383	24664
Changsha . . . . .	♀	1	7-8	23-21-17	137	32	531	17438
Changsha . . . . .	♀	2	7	21-21-17	138-143	34-36	428	17429 and 17444
Yochow . . . . .	♂	1	7	21-21-17	142	40	413	23513
Ningkwo . . . . .	♂	18	7	23-21-17	135-144	34-44	620	24524-24526, 24536-24543, 24558, and 25550-25570
Ningkwo . . . . .	♂	1	6	23-21-17	139	39	174	
Ningkwo . . . . .	♀	9	7	23-21-17	138-147	(8)35-38	540	
Ningkwo . . . . .	♀	1	8-7	23-21-17	142	36	542	
Ningkwo . . . . .	♀	1	7	23-21-16	141	31	425	
Ningkwo . . . . .	♀	2	7	21-21-17	136-145	34-41	538	
Ningkwo . . . . .	juv.	1	7	23-21-17	137			
Chintzu . . . . .	♂	1	7	27-23-17	153	47	496	28278
Hsinglungshan . . . . .	♂	2	7	23-21-17	138-141	39-44	540	21496-21506
Hsinglungshan . . . . .	♂	1	7	23-22-17	142	39	274	
Hsinglungshan . . . . .	♀	5	7	23-21-17	142-147	34-39	574	
Hsinglungshan . . . . .	♀	1	7	21-21-17	144	37	288	
Hsinglungshan . . . . .	♀	1	7	23-19-17	143	37	528	
Hsinglungshan . . . . .	♀	1	7	25-21-17	143	28	612	
Hsinglungshan . . . . .	♀	1	8	21-21-17	143	37	411	21475
13 miles north of Hsinglungshan . . . . .	♂	1	9-8	23-24-17	160	45	297	21493
13 miles north of Hsinglungshan . . . . .	♂	1	7-8	25-23-17	165	42	300	21494
13 miles north of Hsinglungshan . . . . .	♂	1	8-7	23-23-17	168	40	263	21495
Maitaichao . . . . .	♀	1	8	28-25-17	173	43	469	23920
260 miles southeast of Sairusu . . . . .	♀	1	8	23-23-17	181	43	422	28282
Tsetsenwang . . . . .	♂	1	6	24-23-17	170	48	433	28280
40 miles southwest of Tsetsenwang . . . . .	♀	1	8	25-21-17	174	47	568	28281
30 miles northeast of Tsetsenwang . . . . .	♂	1	8-7	24-21-17	165	48	531	28347
Tsagan Nor . . . . .	♂	1	9-7	23-21-17	175	51	460	28279
120 and 150 miles north of Perovsk (western Asia)	♀	2	8	25-23-17	158-163	35	450	43369 and 43370

separating the dorsal gray from the darker gray of the sides of the head. (Description based on a male specimen from Ningkwo.)

The not unusual sexual dimorphism as well as the bewildering variations in upper labial, scale row, ventral and subcaudal counts found in this snake are well illustrated by Table L, which includes almost the entire series preserved in the American Museum.

The hemipenis extends to the seventh subcaudal plate and is forked opposite the fourth. It is spinous proximally, calyculate distally. The first spines arise considerably proximal to the point of forking and persist nearly to the end of the organ, the area occupied by them being much more extensive than that occupied by true calyces. All the spines are short and only the most proximal ones are entirely free from one another, the rest being more or less joined basally until they finally resemble calyces with spinous scallops. Thus the spinous and calyculate areas gradually merge into each other. The sulcus is moderately conspicuous, its lips spinous in the spinous area and calyculate in the calyculate one. (Description based on a specimen from Ningkwo.)

The spines of American Museum No. 28279 from Tsagan Nor are relatively much longer than those of the Ningkwo individual described above. Moreover, in this Tsagan Nor example, the spinous and calyculate areas are not nearly so indistinguishable. The hemipenis of a Hsinglungshan specimen resembles that of the one from Ningkwo rather closely. The significance of these comparisons is discussed below.

As long ago as 1903 (p. 99), Wall noted the bifid character of the *halys* hemipenis.

*Distribution*.—Except as indicated on p. 393 below, *A. halys* is generally distributed over northern China, and I have therefore omitted from the following list of Chinese records all localities north of 32° N. Latitude and west of 110° E. Longitude as well as those north of 34° N. and east of 110° E.

Kiangsu: Shanghai and vicinity; vicinity of Kunshan; Soochow; Wusih; Kiangyin; Chinkiang; Nanking.

Chekiang: Ningpo; Talanshan; Hangchow; Tunglu.

Anhwei: Wangwanshan; Ningkwo; Chiuhuashan; Tatung; Chungmingchih; Chuchow and vicinity.

Kiangsi: Kiukiang and vicinity; Lushan, including Kuling; Pingsiang.

Hupei: Hankow; Ichang; Kweichow.

Hunan: Siangtan; Yohlushan; Changsha; Yochow; Shenchow.

Szechwan: Wanhsien; "Tchi-Gô"; Kwanhsien.

Some previously unpublished records for northern China are to be found on pp. 394 and 396 below.

Stejneger (1907, p. 318) has shown that Boulenger's 1896, p. 526, record for Hoihow is not to be relied upon, and there can be no doubt that the specimen

listed from Hongkong by Nikolsky (1916, p. 283), as well as that reported to be from Kwangtung by Tchang (1932, p. 22), must have actually come from elsewhere.

Distributed from the region of the Caspian Sea eastward across Asia to Japan and southward to the Pescadores Islands and the Yangtze Valley.

*Habits and Habitat*.—The distribution of *halys* on the plains of eastern China is puzzling, for it obviously not only appears to be absent from those north of the Yangtze Valley and south of Peiping but from the mountains of Shantung as well (Jacot, 1923, p. 260, and 1931, p. 42), and yet it occurs in great numbers on the plain about Shanghai. This hiatus in its range cannot be correlated with subspecific distribution because many specimens from just northeast of Peiping have low ventral counts like those from the Shanghai region. As long ago as 1877, Moellendorff (p. 104) stated that "near Peking it is not of frequent occurrence, and during all my rambles through the hills of Chihli I have come across only two specimens." He also recorded the capture of a specimen at the temples of Patachu. More recently, a few records for the general region of Peiping have accumulated as follows:

Vogt, 1924, p. 339—vicinity of Peiping.

Tchang, 1932, p. 22—Peiping (judging by his counts, Tchang's specimens actually came from farther north, probably the Tungling mountains).

Boring, 1932, supplementary sheet to Handb. N. China Amphib. Rept.—Jade Fountain, near Peiping.

Rendahl, 1933, No. 8, p. 21—Hsiling.

Perhaps only a field study will suffice to explain the distribution of *halys* in eastern China, but in the central, western and northern parts of the country, it is of general occurrence and ascends to considerable altitudes; in fact, over most of its range it is essentially a snake of mountains and plateaus. Despax (1913, p. 181) records a specimen taken at 12,467 feet in the Yalung valley of southwestern Szechwan ("Tchi-Gô"). The numerous records given elsewhere show how general the presence of *halys* is in the Yangtze Valley where it frequents flat and mountainous country alike.

Like other vipers, the one under consideration is sometimes remarkably abundant. My field notes describe it as "most generally abundant" about Ningkwo, and other members of the Central Asiatic Expeditions found it extraordinarily common near the boundary of Mongolia and China (Irdin Manha and Tukhum, Andrews, 1932, pp. 197 and 321). Maki (1931, p. 207) states that it is "very common in Korea from north to south," and the series of specimens already recorded from Hsinglungshan (Schmidt, 1927, p. 541, and Stejneger, 1925, p. 97) stand as indisputable evidence of its presence in great numbers there. These facts make its absence from the plain of eastern China, as discussed above, the more conspicuous and inexplicable.

The almost voluminous literature on *halys* contains startlingly few references to its feeding habits. Table LI summarizes the few data that I have been able to accumulate.

TABLE LI. FOOD OF *AGKISTRODON HALYS*

Locality	Stomach Contents or Food	Museum or Reference
Pingsiang . . . . .	mouse or small rat	specimen in Frankfort Museum
Hsinglungshan . . . . .	mammalian hair	American Museum No. 21498
Hsinglungshan . . . . .	remains of a rat	American Museum No. 21499
Hsinglungshan . . . . .	feet of a skink ( <i>Eumeces</i> )	American Museum No. 21500
Hsinglungshan . . . . .	remains of a frog	American Museum No. 21502
Tsagan Nor . . . . .	lizard ( <i>Eremias</i> )	American Museum No. 28279
Far Eastern District . . . .	cockroaches fed to juveniles in captivity	Emelianov, 1929, p. 128
Far Eastern District . . . .	mice and frogs eaten in captivity	Emelianov, 1929, p. 128
Japan . . . . .	frog (one specimen)	Wall, 1906, p. 514

The breeding season of this snake shows remarkably little variation with either latitude or altitude. Table LII summarizes the rather numerous available data on the breeding of *halys*.

*A. halys* apparently does not develop an egg-tooth. Dr. Cochran has very kindly examined for me four fully-developed embryos (U. S. Nat. Mus. Nos. 60857-60860), no one of which possesses the least sign of such a structure.

The disposition of this pit-viper varies noticeably with the individual. At Ningkwo, I found it anything but prone to use its fangs, and Wall (1903, p. 99) failed to get young Shanghai specimens to strike, while, on the other hand, Sowerby (1930, p. 23) states that *halys* is "extremely savage" and fights "fiercely." Wall observed that it vibrates the tail (1903, l.c.) and flattens the body (1906, p. 3) when annoyed. Sowerby (1930, l.c.) has also noted the former behavior.

*Material examined*.—I have seen the following Chinese specimens in museums other than the American Museum, records of which are reliable and have not been previously published: 1 from Kwanhsien, in the Berlin Museum; 1 from Pingsiang, in the Senckenbergisches Museum, Frankfort; 11 from Tunglu, 2 from Kiangsi, and 2 from Taiyuan, in the Museum of Comparative Zoölogy; 4 from Hangchow, 6 from Shanghai, 1 from near Kunshan, 3 from Choni, 4

TABLE LII. DATA ON BREEDING OF *AGKISTRODON HALYS*

<i>Locality</i>	<i>Date</i>	<i>Number of Embryos or Young</i>	<i>Condition</i>	<i>Total Length of Parent</i>	<i>Museum or Reference</i>
Shanghai.....	October 16		Apparently newly born		Wall, 1903, p. 98
Shanghai.....	October 4	12	Young found scattered about adult, all dead		Wall, 1903, pp. 98-99
Far Eastern District	September	4-7	Born in captivity; 150-180 mm. (No. of cases not given)		Emelianov, 1929, pp. 127-128
Sedanka.....		7	Fully-formed embryos	597 mm.	Emelianov, 1929, p. 128
Far Eastern District	"Septemb'r"	"6-10"	Born in captivity		Emelianov, 1929, p. 136
Far Eastern District	October 3	7	Born in captivity; 220-230 mm. long		Emelianov, 1929, p. 136
Suchan River, 42° N. x 133° E.....	September 7	10	In utero; 210-220 mm. long		Emelianov, 1929, p. 136
Hsinglungshan.....	August 7	9	Advanced eggs; one measures 29 x 14 mm.; embryo 85 mm., unpigmented	528 mm.	American Museum No. 21498
Hsinglungshan.....	August 7	12	Advanced eggs; one measures 25 x 20 mm.; embryo 105 mm. long, well developed, pigmented	574 mm.	American Museum No. 21496
China.....		11	Eggs; one measures 18 x 14 mm.; embryo 70 mm. long, unpigmented	504 mm.	American Museum No. 17438
Tsetsenwang.....	May 29	8	Eggs in very early stage; one measures 20 x 11 mm.	568 mm.	American Museum No. 28281
Hsinglungshan.....	August	10	Fully-developed embryos		U. S. Nat. Mus. No. 60856
30 miles E. S. E. of Lanchow.....	July 15	7 each	Two broods; embryos half developed		U. S. Nat. Mus. Nos. 68503 and 68505
30 miles E. S. E. of Lanchow.....	July 15	11	Embryos half developed		U. S. Nat. Mus. No. 68504
30 miles E. S. E. of Lanchow.....	July 15	4	Embryos half developed. Female much smaller than Nos. 68503-05		U. S. Nat. Mus. No. 68506
Probably Korea....	"Young born in September"				Maki, 1931, p. 207
Japan.....	October	8	Born in captivity		Eastlake, 1882, p. 70
Japan.....	June 27	3	Eggs in early stage; no embryos visible		Wall, 1906, p. 514

from 30 miles east southeast of Lanchow, 1 each from Kokonor and 85 miles north of Lanchow, in the U. S. National Museum; and 1 each from Chinkiang and 12 miles northwest of Kolan, in the British Museum.

*Remarks:*—Since Stejneger studied the present species so exhaustively in 1907 (pp. 449-465), Nikolsky (1916, pp. 265-285), Thompson (1916, pp. 61-76), Schmidt (1927, pp. 541-543), Emelianov (1929, pp. 99-163), Maki (1931, pp. 203-210), Rendahl (1933, No. 8, pp. 1-30) and others have contributed to the most perplexing study of this form whose distribution is rivaled in extensiveness by those of few other snakes (Thompson, 1916, p. 62). The conclusions reached fall readily into two categories, namely, those that divide *halys* into many subspecies and those that unite it into a single variable form. Among the workers listed above, Thompson stands alone as champion of the latter procedure, while the others have either followed Stejneger (whose conclusions were of course in part based on those of previous workers as clearly explained by him), or arrived at radically different opinions of their own. The fact that seven herpetologists have written 160 pages on this one snake within a period of twenty-seven years is proof in itself that great difficulties in maintaining or "sinking" its forms must exist, and when one notes that two of the most recent contributors have reached not only new but mutually incompatible conclusions, one is forced to the belief that the problem presents almost insurmountable difficulties or else that most of those interested have been working up blind alleys.

To make a long matter as brief as possible, I shall simply state that my own opinion, for the present at least, is virtually the same as that upheld by Thompson, and proceed to present a simple summary of the pros and cons of the case.

#### REASONS FOR DIVIDING *Agkistrodon halys* INTO SUBSPECIES

1. Specimens from central Asia (especially Mongolia) consistently have higher ventral, subcaudal, upper labial and scale row counts than those from the Yangtze Valley. There is also a noticeable, though not marked, corresponding difference in coloration.

2. As explained in detail above, the hemipenis of a specimen from the lower Yangtze Valley has noticeably shorter spines than that of one from Mongolia, while another from Hsinglungshan agrees with the former. Obviously, these differences correlate well with scale counts. Similar degrees of penial differences have been used elsewhere in this work to help distinguish forms.

#### REASONS FOR UNITING THE PREVIOUSLY DESCRIBED SUBSPECIES OF *Agkistrodon halys*

1. Specimens from Manchuria, Japan, Korea, and parts of northern China exhibit in general ventral, subcaudal, upper labial and scale row counts intermediate between those of central Asia and those of the Yangtze Valley, while more specifically they may show a startling degree of variation in series from a single area, as for example the mountains northeast of Peiping. The data in the table of scale counts show that the males from Hsinglungshan



average only 140 ventrals, while three males from higher altitudes of the same mountains (13 miles north of Hsinglungshan) average 164. If these mountains are the meeting place of two forms, the specimens secured in them should have intermediate rather than extreme counts.

2. The area over which intergrades or specimens not readily assigned to any one form occur is very extensive; in fact, it is as great as that occupied by more than one alleged subspecies. Without doubt, the more thoroughly northern and western China are explored, the greater the already extensive regions of intergradation will become, for almost certainly the higher counts will be found in specimens from the main mountain ranges and more elevated plateaus, the lower in individuals from the river valleys and low mountains.

3. Although the extremes in color pattern exhibited by *halys* at first appear to be radically different, a careful comparison shows that the derivation of one from the other is a relatively simple matter.

4. The differences upon which subspecific and even specific distinctions have been based involve only a uniform decrease or increase in ventral, subcaudal, upper labial and scale row counts. It is easy to assume that such uniform changes are the result of a single factor influencing each ontogeny. Might not an acceleration or retardation of development due to climatic differences produce such results? Even the hemipenial differences involve chiefly a variation in length of spines, the longer spines occurring in the specimens with the higher counts.

5. There is obviously a definite correlation between counts and altitude, and also a less definite but nevertheless discernible one between counts and latitude. Since climatic conditions depend upon altitude and latitude, experimental methods should suffice to prove whether or not, as already suggested just above, *halys* from Mongolia and the high regions of northern China has high counts simply because it is living under climatic conditions seriously affecting its development. Unfortunately, few collectors have taken the trouble to record exact altitudes.

6. Even admitting that valid subspecies do exist, their definition would scarcely be possible without rather complete data on the sexes of recorded specimens. The latest reviewer of the problem did not see fit to record the sex in any series considered, and this in spite of the fact that males have decidedly more subcaudals than females, while sexual dimorphism in ventral counts, though not well developed, is evident as well. This deficiency is only partly obviated by using the sum of ventrals plus subcaudals.

7. A study of the table of scale counts and comparison of specimens from widely separated regions will show that *halys* is prone to vary rather indiscriminately in numerous ways in addition to those discussed above. Must all of these variants receive subspecific recognition?

8. The question of climatic effect on ontogenetic development in snakes is much more important than the doubtfully justifiable "splitting" of one more species, and I am therefore loath to obscure a problem of the first magnitude and of general interest by recognition of uncertain subspecies.

It has long been known that two color phases of *halys* exist, and Schmidt (1927, l.c.) has shown that in Anhwei these are correlated with neither sex, habitat preference, nor variation in scale counts. On the other hand, Emelianov (1929, p. 117, etc.) maintains that in Manchuria and the Far Eastern District two apparently corresponding phases are found differing in scutellation

and habitat preference as well as in coloration. He has named one *blomhoffii ussuriensis* (p. 123) and calls the other *halys intermedius*. Without seeing his material I am unable to reach a final conclusion in regard to the validity of his forms, which are in some respects unlike any I have read of in herpetological literature, but I am inclined to believe that they are not valid geographical subspecies as generally recognized. *Agkistrodon halys* certainly presents numerous and varied problems to taxonomist and experimental biologist alike!

The poison of *A. halys* has recently received attention by Iwano (1927) and Kobayashi (1928).

### 123. *Agkistrodon monticola* Werner

*Ancistrodon blomhoffii monticola* Werner, 1922, Anz. Akad. Wiss. Wien, LIX, p. 222 (type locality, Yaoshan, near Likiang, Yunnan, 3600 meters); 1924, Denkschr. Akad. Wiss. Wien (math.-natur.), XCIX, p. 49 (amplified description of cotypes).—Vogt, 1927, Zool. Anz., LXIX, p. 285 (southern China).

*Agkistrodon strauchi* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 541 (Snow Mountain, north of Likiang, Yunnan) (not of Bedriaga, 1912).

*Agkistrodon strauchi popei* Mell, 1929, Lingnan Sci. Journ., VIII, p. 218 (type locality, northwest Yunnan).

*Description*.—Rostral broader than high, distinctly visible from above; internasals a little wider than long, not greatly narrowed, scarcely produced backward laterally, their posterior margins only slightly curved forward; internasal suture about two-thirds that of prefrontals; frontal much longer than internasals and prefrontals combined but little longer than its distance from tip of snout, shorter than parietals; upper labials 6-6, only the 3rd entering orbit, 4th to 6th about equal in size; preoculars 1-1; postoculars 2-2; anterior temporals 2-2; lower labials 9-9; chin-shields short, scarcely longer than wide; scales in 19 rows from a point opposite the 13th ventral plate of the throat, to the 39th one counted forward from the vent, reduced successively to 18-17-15 rows posterior to this; keeling of scales distinct but not heavy, 2 outer rows smooth on anterior body, only 1 smooth posteriorly; ventrals 140; anal single; subcaudals in 32 pairs. Color, dark brown with very obscure black markings; a pair of indistinct black spots on fronto-parietal area; upper lip light margined, the light color scarcely extending onto the last upper labial; lower lip light margined posteriorly. Total length 470, tail 60 mm.; female. (Description based on the Snow Mountain specimen.)

Werner's (1924, p. 49) two cotypes had 142-145 ventrals, 30-35 subcaudals, and 7-8 upper labials, while the corresponding figures for Vogt's (1927, p. 285) four specimens, undoubtedly collected in Yunnan, are 136-145, 30-31, and 6-7, respectively. A translation of his color description follows:

Of the four specimens in the Schneider collection three are almost entirely black without any markings, only the labials are white in the portion bordering on the edge of the snout; toward the ends here also the color changes gradually to black.

In one animal the underside only is black, the ground color of the dorsal surface is gray. The white color of the labials is continued on 4-5 scales behind the angle of the mouth, form-

ing a short, narrow white stripe. A black V-shaped mark is visible on the dorsal surface of the head. The point begins on the prefrontals, the aperture points backward. A black spot is present on each parietal between the branches. The occiput and neck exhibit two dark arches with black median spot. This regular design is repeated on the back, becomes increasingly indistinct posteriorly and still farther back there are only individual black scales, which no longer form a regular spotted pattern. There are small black spots, formed always of 3-4 scales, on the border of the ventrals as far as the middle of the body. Toward the end of the tail every marking disappears in the increasingly dark coloration.

The hemipenis extends to the eleventh subcaudal plate and is forked opposite the sixth. It is spinous proximally, calyculate distally, the spinous area being nearly twice as extensive as the calyculate one. The numerous spines are small proximally but increase in size distally, reaching their maximum length about opposite the point of forking, beyond which they gradually become smaller again. The line of demarcation between spines and calyces is abrupt but not conspicuous, and does not extend straight across the organ. The calyces have scalloped edges, and, adjacent to the spines, some of these edges are pointed and calcified. The lips of the sulcus are spinous in the spinous area but not conspicuously calyculate in the calyculate one. (Description based on a specimen from Yunnan in the Berlin Museum measuring 335 mm. from snout to vent.)

*Distribution*.—*A. monticola* is known only from Yunnan, where it has been collected in the mountains immediately to the north and slightly west of Likiang.

*Habits and Habitat*.—This small pit-viper is obviously an inhabitant of high mountains. It has been recorded from altitudes of 11,772 to 13,000 feet. The cotypes were taken in steep meadows of the slopes of Yaoshan (Handel-Mazzetti, 1927, p. 139).

The Snow Mountain specimen held 6+3 eggs measuring about 12 x 15 mm. (Schmidt, 1927, p. 541). Since gross examination revealed no embryos and the parent was collected October 16 (not in November as stated by Schmidt), the period of gestation certainly is not completed by *monticola* of this region in a single season. Schmidt records the altitude at which this specimen was taken as 9000 feet, but 13,000 is the figure given in Andrews' field notebook.

*Material examined*.—I have seen 4 specimens from Yunnan, in the Berlin Museum (No. 29793), collected by Schneider; and 1 from Snow Mountain, in the American Museum.

*Remarks*.—Although it is not easy to determine exactly how far from the actual type locality of *monticola* it was that Andrews collected the Snow Mountain specimen identified by Schmidt (1927, l.c.) as *strauchi* and described in

detail above, it is obvious from the accounts of Andrews (1920, pp. 114-133) and Handel-Mazzetti (1927, p. 133) that these two collectors secured their material of *monticola* in the same mountains just to the north and slightly west of Likiang. Andrews' "Snow Mountain" is Handel-Mazzetti's "Schneekette."

As Mell (1929, p. 218) has already indicated, there is certainly no justification for placing *monticola* as a subspecies of *halys* (or *blomhoffii*). It is most closely allied to *strauchi* but specifically quite distinct. Judging by their hemipenes, *halys* and *monticola* are not close relatives.

Mell's (1929, l.c.) *A. strauchi popei* is obviously based on the Snow Mountain specimen of *monticola* referred to so frequently above.

#### 124. *Agkistrodon strauchi* Bedriaga

Plate XXIV, B and C

*Ancistrodon Strauchi* Bedriaga, June, 1912, Wiss. Res. Przewalski Cent.-Asien Reisen, Zool., III, Abt. 4, p. 728, Pl. x (Tunggolo and Tatsienlu, in Hsikang; and the Upper Yangtze; type locality hereby restricted to Tunggolo).

*Agkistrodon tibetanus* Barbour, August, 1912, Mem. Mus. Comp. Zool., XL, p. 133, Col. Pl. II (type locality, Yamala, Hsikang, 13,000 feet).

*Agkistrodon strauchi* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 98 (Anyangpa, Hsikang, 13,000-14,000 feet).

*Description*.—Table LIII records the scale counts of all the known specimens of *strauchi* except the cotypes, the figures in parentheses representing the number of individuals involved.

TABLE LIII. VENTRAL, SUBCAUDAL AND SCALE ROW COUNTS OF  
*AGKISTRODON STRAUCHI*

Locality	Sex	Scale Rows	Ventrals	Subcaudals	Material or Reference
Yamala . . . . .	♂	21	152	43	type of <i>tibetanus</i>
Anyangpa . . . .	♀	(2)21	(2)152-160	(2)37-38	Stejneger, 1925, p. 99 (records one of these as male)
Anyangpa . . . .	♂	23	152	43	Stejneger, 1925, p. 99
Sungpan . . . . .	♀	21-21-15	175	44	U. S. Nat. Mus. No. 67813
Yinkuanchai . .	♀	21-21-17	159	33	U. S. Nat. Mus. No. 81979
Yinkuanchai . .	♂	21-21-17	153	39	U. S. Nat. Mus. No. 81980
Yulunghsi . . . .	♂	21-21-15	149	35	U. S. Nat. Mus. No. 81981

The scale counts of the U. S. National Museum series recorded in the table were made on the neck, at midbody and just before the vent.

Bedriaga's largest cotype measured 439 + 80 mm., while U. S. Nat. Mus. No. 81981, a male, is 350 mm. in length from snout to vent.

Some specimens are uniformly black and almost devoid of any pattern whatsoever.

A translation of the original description, based on the three cotypes, follows:

The moderately deep but in general rather small head, feebly set off from the neck, is flat or only weakly arched forward and backward from the eyes, with sides sloping steeply outward and downward and the edge of the snout perfectly rounded laterally as well as anteriorly. The snout is broad and rounded, the width of the head increases gradually but only slightly posteriorly; the maximum width of the head is contained  $1\frac{2}{3}$ - $1\frac{3}{4}$  times in its length. By closer examination it is ascertained that no trace of a concavity is present anteriorly on the dorsal surface of the head and that the point of the snout slopes rather obliquely outward and downward, so that one cannot speak of an elevated tip of the snout at all in this species; also the edges of the lips are scarcely or not at all raised, and the snout is prolonged very weakly beyond the lower jaw, so that the commissure of the mouth lies distinctly nearer to the tip of the snout than in *A. intermedius*. The small, laterally lying nostrils are thrust rather far forward, for all that, however, little or even not at all distinguishable from in front; the frenal pit is large, yet together with the ring of scales encircling it, takes up little space; the height of this ring of scales is particularly noteworthy, indeed shorter by almost a half than the height of the 3rd supralabial, which touches the eye. The body is moderately long, almost round, feebly flattened on the belly. The short tail, which measures between  $\frac{1}{3}$  and  $\frac{1}{2}$  of the total length, is moderately slender and tapers sharply; its end is provided with a horny tip furrowed laterally and dorsally. The rostral is moderately high and rather narrow, feebly notched below, rather strongly narrowed toward its upper part and more or less bent over onto the dorsal surface of the head, and visible from above. The breadth of the narrowed portion of the rostral, measured between the anterior upper corners of the prenasals, more or less exceeds half of the anterior margin of the nasal bordering the rostral, while the length of the lateral margin of the rostral attains to the length of the distance of the eye from the nostril. The internasals are large; in the individual registered under the number 8534 in the catalogue, they about equal the length of the flatly-arched prefrontals lying behind them. The frontal is broad, in some cases indeed very broad; its forward edge is scarcely broken by an angle in the center, its short sides bordering on the supraoculars converge at an angle; the greatest breadth of the frontal is only a little less than its length, while the latter is approximately equal to its distance from the end of the snout. The supraoculars are moderately large, they attain to the length but not the breadth of the frontal; the parietals on the other hand are longer than the latter shield, yet their length seems to vary. All these plates covering the upper surface of the head are flat and do not overlap. The anterior nasal is moderately large; its anterior margin bordering the rostral is equal in length to the distance of the eyeball from the nostril; the posterior nasal, separated from the prefrontals by the contiguous internasals and upper frenals, is almost as large as the frenal or the uppermost preocular lying behind it; the two lower preoculars diverge anteriorly and form the posterior border of the moderately large frenal pit. The frenal shield together with its pit as well as the two narrow preoculars occupy a small space, so that the distance from the anterior point of the middle preocular, wedged between the upper frenal and the uppermost preocular, to the lower point of the lowermost preocular wedged between supralabials I and II, equals at most a third of the

height of the 3rd supralabial; the latter enters the eye, whereas the 4th supralabial appears separated from the eye by the posterior [typ. err. for "lower"] postocular which extends very far downward; above this postocular, sometimes disposed more horizontally than vertically, is a second moderately large one, on which in turn, sometimes, rests yet a third, which borders on the parietal and the supraocular. The posterior supralabials are strikingly large in comparison with those lying beneath the eye as well as in comparison with the temporals; the height of the 5th supralabial attains to the height of the 4th similarly named shield and either equals the length of the free margin of the 3rd supralabial or exceeds it by a little; likewise the 6th and 7th supralabials are strikingly large. There are 6 or 7 supralabials altogether on each side, and on each side 3 successive temporals decreasing in size posteriorly, the foremost of which rests upon the 4th and the 5th supralabials; furthermore on each side 9 or 10 supra-labials [typ. err. for "sublabials"] and 2 inframaxillaries are present. The scales on the back are small, oblong and rather strongly keeled, those on the flanks are distinctly larger, in particular broader, and besides more weakly keeled; the scales of the lowermost row, likewise in places those of the second lowest, are smooth; the scales on the nape of the neck are almost smooth; the short but broad caudals, rhombic or nearly rhombic in form, are weakly yet noticeably keeled. There are 21 longitudinal rows of scales on the dorsal surface of the body, 149-161 ventrals, 1 undivided anal and 44 caudals in a double series.

The ground color of the dorsal surface is greenish brown, yellowish brown or nut-brown, as is the case with a young individual. The head appears finely dusted, more or less distinctly, on its horizontal surface and exhibits besides larger dark brown spots, which are regularly and symmetrically disposed and show a decided tendency to arrange themselves along the margins of the shields; thus, for example, the frontal, with the exception of the posterior point, is edged with a border or band which also encroaches upon the neighboring plates; the posterior portion of the supraoculars likewise shows transverse bands, and there is a longitudinal band on the outer edge of the parietals; occasionally, however, this band encroaches only a little upon the parietals, but extends more in an oblique direction toward the occipital region. Behind the eye arises a broad dark band, which proceeds diagonally to the angle of the mouth and may continue onto the side of the neck. The sides as well as the lower surface of the head are yellow, unspotted or finely dark-speckled. On the trunk there are four dark brown, narrow, regularly interrupted, zigzag bands interspersed with deep dark brown scales at fairly equidistant intervals. The fragments of these zigzag bands lie with their concave sides exactly opposite one another, so that they constitute two longitudinal rows of rhomboidal figures. In fully grown animals, as far as I may judge by the scanty material before me, cross-bands occur only on the tail. Dark brown spots are visible along the sides of the belly, and the ventral surface of the animal is spotted to varying degrees with dark brown on a dirty yellowish brown background, sometimes, as particularly in the posterior half of the body and on the tail, so strongly spotted that the ventral surface looks entirely dark brown and appears only feebly streaked with greenish yellow or grayish. In the young individual before me, No. 7046, the ground color above is light brown, and the dark brown spots show a tendency to expand in width and are disposed in two or four rows. The ventral surface is gray-brown, thickly sprinkled with yellowish or grayish white.

The hemipenis extends to the ninth subcaudal plate and is forked opposite the fifth to sixth. It is spinous proximally, calyculate distally, the spinous area being about thrice as extensive as the calyculate one. The numerous spines are long and slender and relatively uniform in size save at their origin, where they

are smallest. The line of demarcation between spines and calyces is abrupt but not conspicuous, and extends nearly straight across the hemipenis. The calyces are uniform and not noticeably reduced in size distally. Their edges are scalloped, the scallops long and pointed and irregular in depth. The lips of the sulcus bear small spines in the spinous region, calyces in the calyculate one, and are prominent throughout, but end just proximal to the extremity of the organ. (Description based on the specimen from Yulunghsi.)

*Distribution*.—*A. strauchi* is known only from the following localities:

Hsikang: Upper Yangtze; Yamala; Tungngolo; Yinkuanchai; Tatsienlu; Yulunghsi; Anyangpa.

Szechwan: Sungpan.

*Habits and Habitat*.—As stated by Stejneger (1925, p. 98), this species is apparently found only on the high plateau of western China (Hsikang and Szechwan). It occurs at altitudes of 12,000 to 14,000 feet in Hsikang but as low as 9500 feet in northern Szechwan (U. S. Nat. Mus. No. 67813).

One of the Anyangpa females in the U. S. National Museum measures 450 mm. from snout to vent and contains 7 embryos about one-third developed. It was collected in July. The species is probably ovoviviparous.

*Material examined*.—I have seen the type of *A. tibetanus*, in the Museum of Comparative Zoölogy; 3 specimens from Anyangpa, 2 from Yinkuanchai and 1 each from Yulunghsi and Sungpan, in the U. S. National Museum.

*Remarks*.—*A. strauchi* is closely allied to *monticola*. This is shown by their hemipenes, coloration, distribution and habitat preferences.

Only the acquisition of additional material from the region of Sungpan will indicate the significance of the high ventral count of U. S. Nat. Mus. No. 67813.

#### Genus *Trimeresurus* Lacépède

This large genus is distributed from Ceylon and Peninsular India northward to the Himalayas, thence eastward across Burma and southern China to the Riu Kiu Islands, and southward into the Malay Archipelago, including the Philippines. Many of its numerous species are as yet little understood and call for much further study. The hemipenes have recently been shown to be of major importance in determination of species and groups of species (Pope and Pope, 1933, No. 620).

Anderson's (1879, p. 828) specimen from Pangsi, western Yunnan, identified as *Trimeresurus gramineus*, might well be that species as recently re-defined by Pope and Pope (1933, No. 620, p. 7). I have not included *gramineus* among the Chinese forms of *Trimeresurus* because there is no way of proving beyond doubt the identity of Anderson's snake.

*T. cornutus* Smith, 1930, p. 682, known from one female specimen (the sex given in the original description notwithstanding) collected in the Fansipan Mountains of northern Tongking, is characterized by a horn formed by the three or four supraoculars, and by the following scutellation: 193 ventrals, 68 subcaudals, and scales in 21-21-17 rows. It is certain to turn up in the mountains of southeastern Yunnan. Smith rightly states that it is the only horned *Trimeresurus* known and considers it most closely allied to the Malayan *puniceus*, from which it is, however, amply distinct. I have examined the type. In this connection, the presence of *T. gracilis* Oshima on Formosa, said by Maki (1931, p. 218), its collector, to be an ally of *puniceus* with large, undivided supraoculars not at all raised, is very interesting, not to say puzzling.

Maxwell (1912, p. 244) reports the death of a 33-year-old man in southern Fukien after the bite of a "*Lachesis gramineus*," but it is of course impossible to say whether the snake in question was *T. albolabris* or *T. stejnegeri*.

#### OBVIOUS RECOGNITION CHARACTERS FOR CHINESE SPECIES

Head broad and distinct from neck; top of head covered with numerous small scales; viper-like in both appearance and behavior and with large, erectile fangs present in front part of mouth; a deep pit between eye and nostril.

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. First upper labial partly (rarely not) separated from nasal by a suture; green (rarely with indistinct blackish cross-bands) above, upper lip and belly yellowish or greenish. . . . . *albolabris*, p. 405
- II. First upper labial completely separated from nasal by a suture
  - A. No scales present between nasal and scale forming anterior border of pit; scales in 23-25 rows at midbody. . . . . *monticola*, p. 412
  - B. One or more small scales present (rarely absent in *jerdonii* and *stejnegeri*) between nasal and scale forming anterior border of pit; scales in 19-29 rows at midbody
    1. Scales in 25-29 rows at midbody; more than 190 ventrals. . . . . *mucrosquamatus*, p. 416
    2. Scales in 19 or 21 (23) rows at midbody; fewer than 190 ventrals
      - a. Uniform green above and below save for a narrow stripe along either side of the belly. . . . . *stejnegeri*, p. 418
      - b. An intricate pattern chiefly composed of greenish yellow and black. . . . . *jerdonii*, p. 409

The snakes at present known as *T. monticola* are reported to have from 21 to 29 rows of scales at midbody, but these extremes apparently are not reached by Chinese specimens and I have therefore not used them in the key above. The problem of variation in *monticola* is discussed in detail under that species.



125. *Trimeresurus albolabris* Gray

## Figure 76

- Trimeresurus albolabris* Gray, 1842, Zool. Misc., p. 48 (type locality, China).—Pope and Pope, 1933, Amer. Mus. Novitates, No. 620, p. 9.
- Bothrops erythrurus* Müller, 1878, Verh. Naturf. Ges. Basel, VI, p. 621 (Lilong, Kwangtung) (not of Cantor, 1839).
- Trimeresurus erythrurus* Müller, 1881, Verh. Naturf. Ges. Basel, VII, p. 171 (Chonglok, Kwangtung) (not of Cantor, 1839).—Boettger, 1888, Ber. Offenbach. Ver. Naturk., XXVI-XXVIII, p. 91 (Hainan material collected by Herz; also possibly quoted records for Hongkong and Hainan) (not of Cantor, 1839).
- Trimeresurus gramineus* Boettger, 1894, Ber. Senck. Ges., p. 135 (Hainan, only the specimen with internasals in contact).—Stejneger, 1907, Herp. Japan, p. 480 (part).—Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 205 (Hoihow and Kachek, Hainan; "Five Finger Mt." material not seen by me) (not of Shaw, 1802).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 458 (Nodoa, Hainan) (not of Shaw, 1802); p. 545, fig. 21 (purchased specimen) (not of Shaw, 1802).—Angel, 1929, Bull. Mus. Hist. Nat., Paris, (2) I, p. 81 (Laos) (not of Shaw, 1802).
- Lachesis gramineus* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 554 (part: cotypes of *albolabris*; Hongkong; and others).—Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 143 (part: southern Kwangtung).
- Lachesis gramineus albolabris* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 126 (Shiuhing, Tinghushan, Szewui, Namkong, Lofaoshan and Linping, six Kwangtung localities; Hongkong).
- Lachesis fasciatus* Werner, 1924, Sitzber. Akad. Wiss. Wien (math.-natur.), CXXXIII, Abt. I, p. 47 (part: Hainan).
- Trimeresurus gramineus gramineus* Stejneger, 1927, Proc. U. S. Nat. Mus., LXXII, Art. 19, p. 8 (Kuliang, Fukien [not "Kuling"]) (not of Shaw, 1802).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 478 (Futsing Hsien, Yenping, and Chungan City, Fukien) (not of Shaw, 1802).—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 139 (Lohsiang and Chihhsiu, Kwangsi) (not of Shaw, 1802).
- Trimeresurus gramineus albolabris* Mell, 1931, Lingnan Sci. Journ., VIII, p. 218.

*Description*.—Internasals large, in contact or rarely separated by a single scale; first upper labial never completely but nearly always partly separated from nasal by a suture (only thirty-one specimens examined); generally no, occasionally 1, rarely 2 to 4 small scales present between nasal and scale forming anterior border of pit (thirty-one specimens examined); 2 scales between eye and nasal (thirty-one specimens examined); supraoculars separated by 10-12, rarely 8, 9 or 13 small scales; scales keeled, in 23 or 25, very rarely 21 or 27 rows on the neck, 21 at midbody and 15 before the vent (only thirty-one specimens counted at midbody); ventrals in twenty-one males 153-162, in twenty females 158-167; subcaudals in twenty-one males 65-73, in nineteen females 52-60; the largest males among sixteen measure from snout to vent 485, 476, 474, 465 and 438, the largest females among fifteen 786, 770, 750, 745 and 710 mm. (Except as otherwise indicated, description based on forty-one specimens from Nodoa.)

Adult females can be recognized as quickly by their much greater girth as by their greater length.

In life, the iris of *albolabris* is pale red (Mell, 1922, p. 127).

While going over the series of *albolabris* in the American Museum, I discovered three facts of interest as follows:

1. Fukien and Hainan *albolabris* differ in head coloration, the upper lip of those from the

former locality being white (in formalin), while this part of the head in the Hainan material is pale green. It is even possible that two distinct forms are represented here, but for the present, at least, it is best to regard them as identical.

2. The discovery written of just above brought to light the second fact, i.e., male Hainan *albolabris* nearly always has a distinct white stripe along the dorsal edge of the upper lip just under the eye, while no such stripe is evident in the vast majority of females; consequently adult specimens may be sexed with great ease. On the other hand, the white lip of Fukien *albolabris* entirely or almost entirely conceals its white stripe and this condition is responsible for my (1929, p. 480) implication that the light stripe under the eye of male *stejnegeri* would serve to distinguish it from *albolabris*. Obviously, Hainan *albolabris* could not be separated from *stejnegeri* by the presence or absence of this subocular stripe.

3. As pointed out elsewhere, a distinct sexual dimorphism is exhibited by the lateral stripe along the first row of scales in *stejnegeri*, and I have now determined that such is also the case in *albolabris*, for in this species, instead of being bichromate in males and monochrome in the other sex, this stripe is strong and distinct throughout in males, extending even onto the tail, while in females it is relatively weak or almost absent on the body, and faint or entirely lacking on the tail.

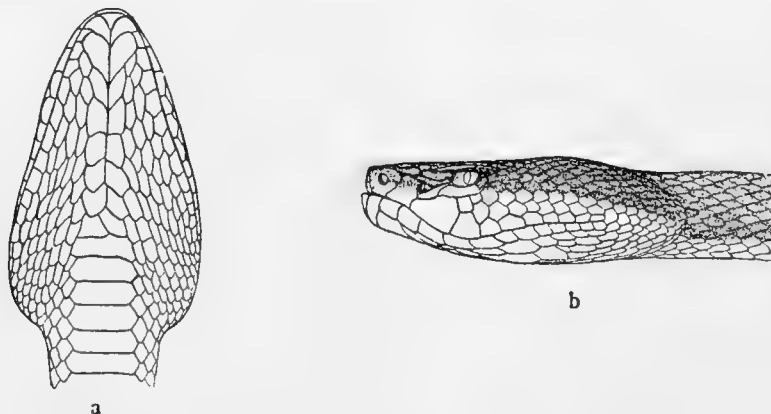


FIG. 76. *Trimeresurus albolabris*. Nat. size. a. Ventral view of head. b. Lateral view of head. A.M.N.H. No. 27935 from Nodda, Hainan.

The amplified description of the female cotype by Pope and Pope (1933, No. 620, p. 9) follows:

Rostral twice as broad at base as at tip, a little broader than high. Internasals broad, elongate, broadly in contact, much larger than adjacent head scales. Nasal not constricted in middle, undivided, not concave, each nasal half separated from its first upper labial by two sutures. Second upper labial high, forming anterior border of pit. Upper part of second upper labial in contact with nasal on both sides. Two scales on a line between eye and nasal, the anterior much the shorter and forming upper angle of canthus rostralis. Supraoculars much longer than horizontal diameter of eye, as broad as largest anterior head scales, and extending backward as far as posterior margin of orbit. Inner margins of supraoculars scarcely broken by sutures, separated by ten to twelve scales. Internasals separated from supraoculars by three scales on one side, four on other, no one of which differs markedly in size or shape from other anterior head scales. Upper head scales smooth, irregular, scarcely increasing in

size anteriorly. Center of line connecting anterior extremities of supraoculars is separated from internasals by four scales. Two postoculars on each side. Suboculars separated from upper labials by one scale on each side. Temporal scales smooth, scarcely enlarged. Pupil vertical. Eye separated from labial border by distance equal to nearly twice its vertical diameter and from tip of snout by three times this diameter. Upper labials 10-11. Lower labials 12-13, first pair in contact behind symphysial. Chin shields regular, first pair somewhat enlarged. All but first two or three outer rows of scales obtusely keeled. Anteriorly, mid-dorsal scales about half as wide as posteriorly. Scale rows 21-19-17-15, the reduction from 21 to 19 taking place somewhere posterior to 70th ventral plate counting forward from anal. Ventrals 152. Anal entire. Caudals 49, divided. Snout to vent approximately 435 mm. Tail 75 mm.

Color uniform green above; yellowish white below. Each scale of first row with light center, the resulting stripe extending from neck, where it is somewhat widened, to vent. On tail, it is present laterally on subcaudals, but soon disappears. The yellowish white color of belly is present on upper lip to horizontal level of lower margin of eye. No postocular stripe. Tip of tail pale reddish.

The hemipenis of the male cotype of *albolabris* is very long and slender, extending to the twenty-first subcaudal plate, and is entirely devoid of spines. It is forked opposite the fifth to sixth subcaudals and finely calyculate distally from just beyond the point of forking. The sulcus lips are prominent throughout. (Pope and Pope, 1933, No. 620, p. 10.)

Proximal to the calyculate area, the extraordinary hemipenis of this snake is papillose. It also might be remarked that the calyces do not have scalloped edges, are somewhat flounce-like in appearance, and involve the lips of the sulcus (Hainan specimen).

*Distribution*.—*T. albolabris* is known in China from the following localities:

Fukien: Futsing Hsien; Kuliang; Yenping; Chungan City.

Kwangtung: Shiu hing; Tinghushan; Szewui; Namkong; Lofaoshan; Lilong; Linping; Chonglok.

Hainan: Hoihow; Tingan; Kachek; Nodoa; Wuchih Mountains.

Kwangsi: Lohsiang; Chinhsiu.

This pit-viper also occurs on Hongkong and Formosa. Its range extends southward from China and Burma through the peninsula of southeastern Asia into the Malay Archipelago to Timor (Pope and Pope, 1933, No. 620, pp. 2 and 10).

*Habits and Habitat*.—Mell (1922, p. 126) found *albolabris* common in level or sloping grass-grown or bush-covered regions of southern Kwangtung at altitudes not exceeding 400 meters. In Fukien, and on Hainan, it frequents the same type of country. Its terrestrial habits are in strong contrast to the arboreal ones of *stejnegeri*, but I believe both species are nocturnal.

Some specimens of *albolabris* bite, strike and even snap viciously when annoyed (Schmidt, 1927, p. 460).

Observations and dissections indicate that *albolabris* eats chiefly rats but also lizards and frogs. The first four of the seven items listed below are based on observations made at Nodoa.

1. A half-grown specimen disgorged a half-grown rat on May 23.
2. On June 4, a foot-and-a-half specimen disgorged an adult *Calotes versicolor*.
3. A 15-inch individual disgorged, on June 30, two half-grown rats, one 3, the other 2.5 inches long.
4. On July 21, a large rat was taken from the stomach of a 33-inch *albolabris*. The neck of this snake was only half an inch in diameter.
5. Schmidt (1927, p. 459) dissected stomachs of this same Nodoa series and found mammals in seven, frogs in three, and a lizard (*Calotes versicolor*) in one.
6. I saw a Futsing Hsien specimen disgorge a rat.
7. Another Futsing Hsien specimen dissected in the American Museum contained a rat (Pope, 1929, p. 478).

The rats found in *albolabris* are apparently domestic ones. This indicates a fondness for the proximity of human habitations on the part of the species in question. It is interesting to note that immature *albolabris* can swallow relatively large rats, so it may be concluded that, on the whole, these pit-vipers are formidable enemies of both large and small house rats. I believe that rats even too large to be swallowed are often struck and killed by half-grown *albolabris*.

American Museum No. 34286 from Chungan City was secured between April 25 and September 3 and contains 4 advanced but scarcely pigmented embryos, one of which measures about 105 mm. in total length. This individual proves the ovoviviparity of *albolabris* beyond a doubt. It is extremely interesting to note that what is almost certainly the beginning of an egg-tooth can be made out on each of these embryos. A Nodoa specimen contains 7 eggs in an early stage of development.

*Material examined*:—I have seen the following specimens from China: the 2 cotypes, in the British Museum; 8 from Tingan and 3 from the Wuchih Mts., in the Naturhistorisches Museum, Vienna; 7 from Kwangtung, in the Berlin Museum; 1 from Kuliang, in the U. S. National Museum; 41 from Nodoa, 8 from Futsing Hsien, 1 each from Yenping, Chungan City, and an unknown Chinese locality, in the American Museum.

Mr. Schmidt very kindly examined for me 2 Kwangtung examples, one from Lilong, the other from Chonglok, in the Museum d'Histoire Naturelle, Basel.

*Remarks*:—The synonymy given above includes all the references in the literature that are certainly based upon material of *albolabris*. Many additional ones have been omitted because of the impossibility of determining whether they refer to *albolabris* or to *stejnegeri*.

126. *Trimeresurus jerdonii* Guenther

## Plate XXV

*Trimeresurus jerdonii* Guenther, 1875, Proc. Zool. Soc. London, p. 233, Pl. xxxiv (type locality, Khasya).

*Trimeresurus xanthomelas* Guenther, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 221 (type locality, Ichang, Hupeh); 1892, in Pratt's Snows of Tibet, p. 241, Pl. 1.

*Lachesis jerdonii* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 551.

*Lachesis melli* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 143.—Mell, 1922, p. 126 (type locality, between Chao and Hsiaotsun, Yunnan, 2700 meters).

*Trimeresurus jerdonii melli* Mell, 1929, Lingnan Sci. Journ., VIII, p. 218.

*Trimeresurus jerdonii xanthomelas* Mell, 1929, l.c.

*Description*.—Internasals not in contact; first upper labial completely separated from nasal by a suture; 1 or more small scales nearly always present between nasal and scale forming anterior border of pit; ventrals in three males 164-170, in female 168; subcaudals in two males 51-54, in female 44. (Description based on four specimens from Tungchwan.)

I have brought together all the available data on ventral and subcaudal counts of Chinese specimens because Mell (1929, p. 218) considers *melli* a valid subspecies based on a low number of ventrals and subcaudals and confined to Yunnan. In addition, he revives Guenther's *xanthomelas* for Szechwan and Hupeh material with rather high counts. If these Chinese forms are recognized, it is difficult to say just what should be done with *jerdonii* from regions west of Yunnan where its counts (172-175 ventrals) are, for the most part, intermediate between those of Szechwan and Yunnan examples (Boulenger, 1893, p. 552, and Wall, 1910, p. 233). Venning (1911, p. 775), on the other hand, gives the ventral counts of three Chin Hills individuals as 164, 172, and 181! I can only conclude that *jerdonii* is not readily divisible into good geographic forms, and if new data do substantiate Mell's conviction, I am sure that, in China, *melli* will be found in southwestern Szechwan and northern Yunnan, *xanthomelas* in central and eastern Szechwan and Hupeh.

In Table LIV, figures in parentheses indicate the number of specimens counted.

The original description, based on three specimens, follows:

The second upper labial shield forms the front part of the facial pit; one or more small shields between the supranasals. Scales on the upperside of the head very small, almost granular, those of the body keeled, in twenty-one series. One or two longitudinal rows of scales above, and nearly as large as, the posterior labials. Supraciliary not divided. Ventrals 164-172; subcaudals 42-60. Upper parts greenish brown, with a vertebral series of irregular subrhombic black markings and another series of vertical black spots along the side of the body. Upperside of the head with symmetrical black spots, and an oblique black band from the eye to the angle of the mouth. Lower side yellowish, posteriorly marbled with blackish.

The deeply forked hemipenis is spinous proximally, calyculate distally, the spinous and calyculate areas being about equal in extent and sharply set off from each other. The numerous spines, though very small proximally, enlarge

TABLE LIV. VENTRAL AND SUBCAUDAL COUNTS OF *TRIMERESURUS JERDONII* FROM YUNNAN, SZECHWAN AND HUPEH

Locality	Sex	Ventrals	Subcaudals	Museum or Reference
between Yungping and Yungpeh....		(3 or 4) 160-169	(3 or 4) 54-56	Vogt, 1927, p. 286
between Chao and Hsiaotsun.....		166 or 169	54	type of <i>melli</i>
Tungchwan.....	♂	(3) 164-170	(2) 51-54	British Museum
Tungchwan.....	♀	168	44	British Museum
Yachow Prefecture	♀	(2) 184	(2) 63	U. S. Nat. Mus. Nos. 75717-18
Yachow.....	♀	(2) 175-181	(2) 60-67	U. S. Nat. Mus. Nos. 76261-62
Yachow.....	♂	172	62	U. S. Nat. Mus. No. 76263
Kiating.....		188	54	Boulenger, 1896, p. 552
Mt. Omei.....	♀	176	42+	Stejneger, 1925, p. 101
Mt. Omei.....	♂	(2) 173-175	(2) 58-65	U. S. Nat. Mus. Nos. 69933-34
Mt. Omei.....		179	57	Chang, 1932, p. 76
Washan.....	♂	183	69	U. S. Nat. Mus. No. 69931
Süchow.....	♂	179		U. S. Nat. Mus. No. 76246
Ichang.....	♂ + ♀	(5) 180-187	(5) 55-67	Boulenger, 1896, p. 552

rapidly toward the calyculate area until their maximum size is reached in the region farthest from the sulcus where they are very long and slender, with 2.5 mm. free ends. Nearer the sulcus, they do not attain such a length, and remain very short immediately adjacent to it. The calyces strongly suggest flounces, and the sulcus is undivided in each fork. (Description based on a cotype of *xanthomelas*.)

*Distribution*.—This pit-viper has been secured at the following localities in China:

Yunnan: between Yungping and Yungpeh; between Chao and Hsiaotsun; Yunnanfu; Tungchwan.

Szechwan: Yaochi, near Muping; Yachow and Yachow Prefecture; Kiating; Mt. Omei; Washan; Süchow.

Hupei: Ichang.

*T. jerdonii* is known also from the Khasi Hills, Assam, and the North Chin

Hills, Burma. It has recently been recorded from the Burma-Tibet frontier (Smith, 1932, p. 479).

*Habits and Habitat*.—*Trimeresurus jerdonii* is preëminently a snake of high mountains, a fact that may be illustrated by Table LV.

TABLE LV. ALTITUDE RECORDS FOR *TRIMERESURUS JERDONII*

Locality	Altitude in Feet	Reference or Museum
Khasi Hills.....	4500-5500	Wall, 1908, pp. 312 and 337
Chin Hills.....	6500	Wall, 1910, p. 231; Venning, 1910, pp. 331 and 343
between Chao and Hsiaotsun.....	8858	Mell, 1922, p. 126
Mt. Omei.....	about 6000	U. S. Nat. Mus. No. 64639
Mt. Omei.....	7546	Chang, 1932, p. 76
Washan.....	8000	U. S. Nat. Mus. No. 69931
Yaochi, near Muping...	7400-8000	U. S. Nat. Mus. Nos. 79710-19

Other localities, such as Kiating, Süchow, and Ichang indicate its occurrence at much lower altitudes, but records for these localities are probably based on specimens from mountains near the places in question. The exact level to which *jerdonii* descends cannot be determined until more detailed field data are available. Mell (1922, p. 126) collected the type of *melli* in scrub woods ("Buschwald"), while Chang's (1932, p. 76) Mt. Omei individual was secured in a forest. Venning (1910, p. 343) found three specimens on a rifle range in the Chin Hills, and Wall (1910, p. 233) reports a female taken on the banks of a "nullah" in the same hills.

A specimen in the U. S. National Museum from Yaochi, near Muping, contains two, another from the same locality three, very young babbling thrushes (Timaliidae), probably advanced nestlings, while the stomach of another Szechwan *jerdonii* in the same museum holds the remains of a shrew. I know of no other information on the feeding habits of this pit-viper. Since these babbling thrushes are ground-nesting birds, their discovery cannot be taken as indication of arboreal tendencies on the part of *jerdonii*.

A captive female gave birth to 4 young in the Chin Hills on September 12, 1908 (Venning, 1910, l.c.), while another from these same hills contained 6 advanced embryos when killed on August 1 (Wall, 1910, l.c.). Dissection of seven gravid females in the U. S. National Museum indicates that the breeding

season in Szechwan is somewhat earlier than in the Chin Hills unless the period of gestation is very long in *jerdonii*. A brief summary (Table LVI) of the results obtained by a study of the Szechwan snakes, all of which contained embryos still in rather early stages of development, will serve to illustrate my point.

TABLE LVI. DATA ON BREEDING OF *TRIMERESURUS JERDONII* IN SZECHWAN

Locality	Number of Specimens	Date	Number of Embryos
Yaochi, near Muping . . . . .	3	July 3-12	2 (small female), 5 and 7
Yachow Prefecture . . . . .	2	May	5 and 8
Yachow . . . . .	1	June	7

*Material examined*.—I have seen the following Chinese specimens: 5 cotypes of *xanthomelas* from Ichang, 1 example from Kiating, and 4 from Tungchwan, in the British Museum; 1 from Yunnanfu, in the Naturhistorisches Museum, Vienna; 11 from Yaochi, near Muping, 2 from Yachow Prefecture, 3 from Yachow, 3 from Mt. Omei, 1 from Washan, and No. 76246 from Süchow, in the U. S. National Museum; the type of *melli* from between Chao and Hsiaotsun, and 3 specimens from between Yungping and Yungpeh, in the Berlin Museum.

I have also seen the 3 cotypes of *jerdonii* in the British Museum.

*Remarks*.—Wall (1910, p. 231) has described in detail and figured the egg-tooth of this ovoviviparous species as seen in advanced embryos from the Chin Hills. The American pit-viper, *Agkistrodon mokasen*, another ovoviviparous species, also develops an egg-tooth (American Museum Nos. 43324-43326). Wall believes that the egg-tooth in *jerdonii* serves to enable the young snake to escape from the investing membrane after birth but only direct observation could establish this point. Quite possibly it has no function in such cases but merely indicates that a rapid change from oviparity to ovoviviparity has taken place.

#### 127. *Trimeresurus monticola* Guenther

Plates XXIV, D and E, and XXVII, A

*Trimeresurus monticola* Guenther, 1864, Rept. Brit. India, p. 388, Pl. xxiv (type localities, Nepal and Sikkim); 1892, in Pratt's Snows of Tibet, p. 241 (Kiating, Szechwan, 1070 feet); 1896, Ann. Mus. Zool. Acad. Sci. St. Pétersbourg, I, p. 206 (Lungan, Szechwan).—Anderson, 1879, Zool. Res. W. Yunnan, p. 832, Pl. Lxxvi (outskirts of Husa, Yunnan).

*Lachesis monticola* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 548.

*Trimeresurus orientalis* Schmidt, 1925, Amer. Mus. Novitates, No. 175, p. 3 (type locality, Shaowu, Fukien); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 544 (amplified description of type).

*Trimeresurus monticola monticola* Mell, 1931, Lingnan Sci. Journ., VIII, p. 218.

*Trimeresurus monticola orientalis* Mell, 1931, l. c.



*Agkistrodon monticola* Pope, 1932, in Andrews' Nat. Hist. Cent. Asia, I, p. xlvii and Pl. cix (Fukien) (not of Werner, 1922).

*Description*.—Internasals large, in contact, occasionally separated by a single scale; first upper labial completely separated from nasal by a suture; no small scales between nasal and scale forming anterior border of pit; 2 scales between eye and nasal; supraoculars separated by 7 or 8, occasionally 6 small scales; scales smooth, or very weakly keeled on posterior middorsum, in 25, occasionally 26 or 27, very rarely 23 or 28 rows on the neck, 23, rarely 25 at mid-body, and 19 before the vent; ventrals in three males 137-138, in eleven females 137-144; subcaudals in three males 41-43, in eleven females 36-38; largest females from snout to vent 535, 530, 525, 525, 520 and 503 mm., males immature. (Description based on fourteen specimens from Chungan Hsien, half of which are young from the same clutch of eggs.)

A few or even all of the subcaudals are entire (Steindachner, 1906, p. 908; etc.). The maximum size attained is 859+118 mm. (Wall, 1925, p. 821, specimen from Taunggyi).

The original description follows:

The second upper labial shield forms the front part of the facial pit; a pair of small shields behind the rostral. Scales on the head smooth, those of the body slightly but distinctly keeled, in twenty-three series. Ventrals 137-141; subcaudals 41. Male blackish ash, female and young pale brown; two series of square black spots along the back: the spots of the two series are either placed alternately with each other, or they are confluent into a single series of large quadrangular spots; sides with small, rounded black or brown spots; a white or yellow streak runs from the back edge of the eye to the side of the neck; the middle of the neck with a Y-like yellow or whitish mark, more distinct in the male than in the female; belly densely marbled with brown.

The deeply forked hemipenis is spinous proximally, calyculate distally, the spines covering a much more extensive area than the calyces, which are about uniform in size and structure and with unscaloped but slightly irregular edges. The spines decrease in size distally and are numerous, a few of the proximal ones being very large. The sulcus is prominent throughout. (Description based on a 467 mm. male, American Museum No. 43353, from Chapa, Tongking, with internasals widely separated by two transverse series of scales, the anterior series consisting of four small, the posterior of two much larger scales.)

*Distribution*.—*T. monticola* is known from the following localities in China:

Yunnan: outskirts of Husa; Tali region.

Szechwan: Lungan; Kiating; Hualienszu, Mt. Omei; Chouchiakou; Yunnan border south of Süchow.

Chekiang: (no specific locality).

Fukien: Chungan Hsien; Shaowu.

Distributed southward from China through the Malay Peninsula to Suma-

tra and westward from Yunnan through Assam and Burma into the Himalayas. It is well known on Formosa (Maki, 1931, p. 225).

*Habits and Habitat*.—All observers agree that *T. monticola* is an inhabitant of mountains. Stoliczka long ago (1871, p. 445) recorded its vertical range in the Himalayas as two to eight thousand feet. A specimen in the U. S. National Museum (No. 68163) was collected at 7000 feet on Mt. Omei, while Guenther's 1892 (p. 241) Kiating record as well as other specimens in the U. S. National Museum indicate that it also occurs at much lower altitudes in Szechwan. I found it only in the high Kuatun-Sanchiang mountains of Fukien. In spite of the frequent references to this snake in the literature, few have given good details concerning its exact habitat preference. Leigh (1910, p. 3) states that, about Kurseong, it prefers the vicinity of dwellings and describes the capture of specimens in an outhouse, dwelling houses, a garden, the vicinity of a school playground, and a jungle.

This pit-viper subsists on mammals, chiefly rats and mice (Wall, 1908, p. 335; 1909, p. 357; and Leigh, 1910, l.c.). A Fukien specimen examined by me (1929, p. 476) contained a shrew.

The breeding habits of *monticola* are now well known. The eggs were first reported briefly by Miller in 1904 (p. 729), while a few years later Leigh (1910, l.c.), in his excellent general account of this pit-viper at Kurseong, described the discovery, on August 25, of a clutch of 11 eggs buried in a tea garden and guarded by a female. Wall (1911, p. 284) has described embryos just over an inch long taken from a gravid specimen, so the eggs, when deposited, obviously are already well advanced in development. I (1929, pp. 475 and 476) have given the following detailed record of the breeding of *monticola* in Fukien:

I was told about this viper by the Kuatun Chinese for three months before being able to secure any. This is probably because these snakes are so secretive that only the nesting females can be found. All of my large examples are females so the whereabouts of the males remains somewhat of a mystery.

The Kuatun people prepare from bamboo a coarse fibre from which paper is made. This necessitates the shredding of great quantities of bamboo, and waste material from this process lies all about in low piles. It was in one of these that a beautiful *monticola* nest was found August 12, at Upper Kuatun. The snake did not desert the nest and on the 16th I photographed it. The female remained on guard until the eggs had actually been removed. They were deposited in a roughly rounded cavity some twelve inches below the surface of the very low pile of decaying, fibry waste. The eggs, six in number, were white and adherent in a globular mass. Four were measured and found to range from 26 to 40 mm. in greater diameter, and from 23 to 24 in the lesser. One contained a barely pigmented embryo 128 mm. long.

Again on the 16th, and not far away, I was shown another nest freshly dug up in a grassy, open tea field. The adult guarded the eggs but the nest had been so deranged that its form or depth could not be made out, though obviously it had been within a few inches of the surface. The eggs were white, adherent and slightly longer than those from the first nest, the largest being 42 mm. long. One embryo was faintly pigmented and 140 mm. long.

A batch of five *monticola* eggs that had been roughly handled, was brought in on the 12th of August. They were like those already described.

Several eggs from the above batches were kept but all the young emerged by September 12.

Four Kuatun hatchlings in the American Museum (Nos. 34288-89 and 34292-93) have egg-teeth. Nos. 34294, 34290, 34289, 34291 and 34293 hatched between September 6 and 12, and measure 195, 189, 187, 187 and 183 mm. in total length, respectively.

The disposition of *monticola* is, according to Wall (1908, l.c.), bad, for it strikes "upon small provocation." He (1928, p. 125) has described the effects of its bite, which is not ordinarily fatal. I found Fukien specimens rather sluggish and disinclined to strike except when guarding eggs.

*Material examined*:—I have seen the following examples from China: the type of *orientalis* from Shaowu, 14 specimens and 2 lots of embryonic material from Chungan Hsien, in the American Museum; 2 specimens from Kiating, in the British Museum; 1 each from Hualienszu on Mt. Omei and the Yunnan border of Szechwan, south of Süchow, and 2 from Chouchiakou, in the U. S. National Museum.

I have also seen Guenther's cotypes in the British Museum.

*Remarks*:—The variations of *monticola* are indeed most perplexing and as yet I have been unable to correlate any of them with geographical distribution. I am strongly inclined to believe that if two forms exist north of the lower Malay Peninsula, one will prove to be distributed from the Himalayas across China to Formosa, the other from Tongking and southern Burma southward as far as the Isthmus of Kra. This belief is supported by the absence of *monticola* in much of southeastern China. If the northern (Himalayas to Formosa) snakes do prove to represent a distinct form, it should of course be known as *monticola monticola*. The characters used by Schmidt (1925, No. 175, p. 3) and Maki (1931, l.c.) do not, in my opinion, serve to distinguish eastern (*orientalis*) from western material. Werner expressed the same opinion in regard to Schmidt's *orientalis* some time ago (1926, p. 144). As to the distinctness of *monticola* from regions south of China (including perhaps part of Yunnan) and north of the Isthmus of Kra, I am inclined to think that collation of the internasals and scales separating them will prove fruitful because I have seen material from this region with greatly reduced internasals separated by many small scales, a condition never found in Fukien and Formosan *monticola* at least (Maki, 1931, l.c.).

Stoliczka (1870, p. 224) hesitatingly described a specimen from Penang with 29 subcaudals as a new species, calling it *convictus*. I have recently seen the Singapore specimen with only 24 subcaudals in the British Museum, and

cannot help conjecturing that these short-tailed snakes from the lower Malay Peninsula will also turn out to be distinct enough to warrant the revival of Stoliczka's name which has long reposed in the synonymy of *monticola*.

128. **Trimeresurus mucrosquamatus** (Cantor)

Plate XXVI

*Trigonocephalus mucrosquamatus* Cantor, 1839, Proc. Zool. Soc. London, p. 32 (type locality, Naga Hills, Assam).

*Trimeresurus mucrosquamatus* Guenther, 1864, Rept. Brit. India, p. 390.—Swinhoe, 1870, Proc. Zool. Soc. London, p. 411, Pl. xxxi (Formosa).

*Lachesis mucrosquamatus* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 552 (Formosa).

*Description*.—Internasals small, separated by small scales; first upper labial completely separated from nasal by a suture; small scales present between nasal and scale forming anterior border of pit; more than 2 scales between eye and nasal; supraoculars separated by 13 to 16, very rarely 12, small scales; scales keeled, in 25, occasionally 27, rows on the neck, 25, rarely 27 at midbody, and 19 before the vent; ventrals in males 201-218, females 205-214; subcaudals in seven males 82-91, in four females 78-88. Color, brown with one middorsal row of large and 2 lateral ones of smaller dark brown, faintly black-margined blotches, those of the middorsal row sometimes more or less divided medially and alternately confluent; belly light brown, each ventral plate with 1 to 4 pale yellow spots. The males measure 723, 627, 610, 605, 550, 380 and 281, the females 970, 858, 797, 728, 691, 530 and 271 mm. from snout to vent. (Description based on ten specimens from Yenping and four from Futsing Hsien.)

The foregoing measurements show that the females are much larger than the males.

The rather small amount of variation found in the ventral and subcaudal counts of this snake is illustrated by Table LVII, in which the figures inserted parenthetically indicate the number of specimens counted.

Steindachner (1913, p. 357) has given excellent figures of the skull of *mucrosquamatus*.

The hemipenis extends to the fifteenth subcaudal plate and is forked opposite the seventh. It is spinous proximally, calyculate distally, the spinous area being about twice as extensive as the calyculate one. Two large spines, each with a 3 mm. free end, arise just proximal to the point of forking, on either side of, and slightly removed from the sulcus. Both pairs of large spines are followed (in each fork) by approximately eight smaller ones of the same form but successively reduced in size distally. All of these relatively large spines are separated longitudinally from the sulcus by narrow series of very small ones, while just proximal to the calyculate area numerous spines of intermediate size are present. Proximal to the two pairs of large spines, the organ is beset with

TABLE LVII. VENTRAL AND SUBCAUDAL COUNTS OF *TRIMERESURUS MUCROSQUAMATUS* FROM CHINA AND FORMOSA

Locality	Sex	Ventrals	Subcaudals	Reference
Formosa.....	♂ + ♀	(14)200-219	(15)72-96	Maki, 1931, p. 229
Yaoshan.....	♂ + ♀	(11)209-219	(11)79-96	Fan, 1931, p. 138
Süchow.....		(1)205	(1)77	Stejneger, 1925, p. 100
Wenchwan.....		(1)209	(1)88	Stejneger, 1925, p. 100
Opien Hsien.....		(3)198-210	(2)79-81	Chang, 1932, p. 74
Hsiaomienhsi, Hochuan...		(1)207	(1)93	Chang, 1932, p. 74
Yenchingkou.....	♀	(1)206	(1)86	Schmidt, 1927, p. 545

very minute ones. The line of demarcation between spines and calyces is abrupt, but does not extend in a straight line across the organ. The calyces are small and uniform in size save for an inconspicuous, narrow, longitudinal area of slightly enlarged ones. The sulcus divides a short distance proximal to the point of forking and has small but distinct lips scarcely encroached upon by either spines or calyces. (Description based on a specimen from Yenping.)

*Distribution*.—*T. mucrosquamatus* is known from the following localities in China:

Fukien: Yenping; Futsing Hsien; hills north of Yungchun.

Kwangtung: mountains of north; Lungtou.

Kwangsi: Lohsiang; Chinhsiu; Kuchen.

Szechwan: Yenchingkou; Chungking; Hsiaomienhsi, Hochuan; Süchow; Chouchiakou; Hsinchang; Yenchinghsi; Wenchwan.

There is little doubt that this pit-viper does not occur in the high mountains of northwestern Fukien (Pope, 1929, p. 477). It is, however, well known on Formosa (Stejneger, 1907, p. 467, and Maki, 1931, p. 227) and extends its range southward in the east to Tongking (Mocquard, 1897, p. 213).

Examination of Vogt's (1924, p. 339) "*Lachesis mucrosquamatus*" from Kwanhsien proves it to be *Agkistrodon halys*.

*Habits and Habitat*.—Maki (1931, p. 228) states that *mucrosquamatus* is "very common in Formosa on hills and in woods." As far as I can determine, it has much the same habitat preference in China, where it is found at all altitudes in hilly or mountainous regions. In Fukien, I collected specimens near the top of the high Yenping mountains, while Chang (1932, p. 74) reports two secured at 1300 meters in Opien Hsien, Szechwan, and Mell (1922, p. 126) gives its vertical range in northern Kwangtung as 600 to 900 meters. On the

other hand, there is little doubt that it descends to a very few hundred feet above sea-level in the mountains of Futsing Hsien.

I have already (1929, l.c.) described the discovery, during a single lunch hour, of two individuals in a high mountain village near Yenping, one well above the ground just under the roof of an inhabited farmhouse, and the other in a rock wall nearby. Swinhoe (1870, p. 412) writes of one "captured at Takow [Formosa], in the hall of a neighbouring Mandarin's office, having descended from the roof, in which it was lodged, by a rope on to a hanging lamp in pursuit of geckos (*Gecko japonicus*)."

A Szechwan specimen in the U. S. National Museum (No. 69393) contains bird remains. In Fukien, I saw one example disgorge a bird, each of two others a rat (Pope, 1929, l.c.).

Three Yenping females contain 5, 9, and 13 well-formed eggs (Pope, 1929, l.c.) with embryos still too small to be revealed by gross examination. These specimens in all probability were collected between April 12 and June 2, but if not then, between July 29 and August 6.

*T. mucrosquamatus* has a sluggish disposition and is generally reluctant to strike (Pope, 1929, l.c.).

*Material examined*:—I have seen the following specimens from China: 1 from Lohsiang, in the Museum of Comparative Zoölogy; 7 from Süchow, 1 each from Chouchiakou, Wenchwan, Chungking and Lohsiang, in the U. S. National Museum; 11 from Yenping, 4 from Futsing Hsien, and 1 from Yenchingkou, in the American Museum.

*Remarks*:—Wall (1925, p. 251) has questioned the Naga Hills as the true type locality of *mucrosquamatus*, chiefly because in 1925 no additional Indian material had been secured. Very recently, however, Prater (1929, p. 998) has reported a specimen taken at Pasighat (26° 43' N. Lat. x 97° 42' E. Long.) in northern Burma not very far from the Naga Hills, so there is no longer reason to doubt the presence of this pit-viper in the northeastern extremity of the Naga country.

Work has been done on the venom of this snake by Hara (1928, p. 1110+) and the effect of its bite reported by Maxwell (1912, p. 244) and Sakia (1929, p. 998). The results of the bites recorded by Maxwell were fatal to two of the three children bitten, while the third child had to have its leg amputated. Such effects are much more severe than those described by Sakia.

#### 129. *Trimeresurus stejnegeri stejnegeri* Schmidt

Figure 77

*Trimeresurus gramineus* Boettger, 1894, Ber. Senck. Ges., p. 135 (Hainan, only the specimen with internasals not in contact).—Stejneger, 1907, Herp. Japan, p. 480, figs. 370-372 (part); 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 101 (Mokanshan, Chekiang) (not of Shaw, 1802).

- Lachesis gramineus* Boulenger, 1896, Cat. Snakes Brit. Mus., III, p. 554 (part: near Ningpo; and others); 1899, Proc. Zool. Soc. London, p. 166 (Kuatun, Fukien) (not of Shaw, 1802).—Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 143 (part: mountains of Kwangtung).—Werner, 1924, Denkschr. Akad. Wiss. Wien (math.-naturg.), XCIX, p. 49 (Taolin, Hunan) (not of Shaw, 1802).
- Lachesis gramineus gramineus* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 127 (part: mountains of northern Kwangtung near the Hunan and Kiangsi boundaries, 500-900 meters).
- Trimeresurus stejnegeri* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 4 (type locality, Shaowu, Fukien); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 546, fig. 22 (amplified description of type; two paratypes recorded, one from Futsing, Fukien, the other from an unknown locality).—Pope and Pope, 1933, Amer. Mus. Novitates, No. 620, p. 5.
- Trimeresurus gramineus stejnegeri* Stejneger, 1927, Proc. U. S. Nat. Mus., LXXII, Art. 10, p. 9 (Kuatun, Fukien; Tunglu, Chekiang; probably Kiangsu).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 478 (Futsing Hsien, Yenping and Chungan Hsien, Fukien).—Mell, 1931, Lingnan Sci. Journ., VIII, p. 218.—Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 141 (Kuchen, Kwangsi).
- Trimeresurus* Pope, 1928, Nat. Hist., New York, XXVIII, p. 258 (habits).

*Description*.—Internasals small, separated by small scales; first upper labial completely separated from nasal by a suture; 1 or 2, very rarely 3 or no small scales present between nasal and scale forming anterior border of pit; 2 scales between eye and nasal; supraoculars separated by 11 to 13, rarely 10, very rarely 9 or 14 small scales; scales keeled, in 21 or 23 rows on the neck, 21 at midbody, and 15 before the vent; ventrals in twelve males 161-171, in thirteen females 161-171; subcaudals in twelve males 68-74, in twelve females 60-70; four largest males from snout to vent 670, 653, 611 and 592, females 731, 725, 682 and 625 mm. (Description based on seven specimens from Futsing Hsien, eleven from Yenping and twenty-eight from Chungan Hsien.)

I have already (1929, p. 480) shown that *stejnegeri* exhibits a marked sexual dimorphism in head pattern, the lateral stripe usually extending to the eye, occasionally only to the angle of the jaw or even ending on the neck in males, while in the other sex it is but occasionally evident on the head at all. There is also a sexual difference in the color of the first row of scales: in the males, the lower half of each scale of this row is generally red, while in females this lower half is nearly always green (p. 481).

In life, the iris of this species is deep brick red (Mell, 1922, p. 128).

The amplified description of the type specimen, a male, by Pope and Pope (1933, No. 620, p. 5), follows:

Rostral two and one-half times as broad at base as at tip and much broader at base than high. Internasals indistinct, not or barely elongate; separated by four scales about size of internasals. Nasal not constricted in middle, not divided, not concave, completely separated from first upper labial on both sides; second upper labial high, forming anterior border of pit. Upper part of second upper labial separated from nasal by one medium-sized scale on one side, in contact with nasal on other. Two scales on a line between eye and nasal, posterior one a little deeper and longer; anterior one forming upper edge of canthus rostralis, which is distinctly projecting. Supraoculars narrow, with slightly irregular inner margins and separated from one another by twelve head scales; one supraocular divided anteriorly. Internasals separated from supraoculars by four scales on each side, no one of which differs markedly in size or shape from other anterior head scales. Upper head scales medium and fairly

regular in size, not noticeably enlarged anteriorly; smooth. The center of line connecting anterior extremities of supraoculars is separated from scale between internasals by four to five scales. Postoculars 2-3; suboculars separated from upper labials by two scales on each side. Temporal scales not or only slightly enlarged, smooth. Pupil subelliptical. Eye separated from labial border by a distance equal to its horizontal diameter and from tip of snout by two and a half times this diameter. Upper labials 10-11. Lower labials 13-12, first pair

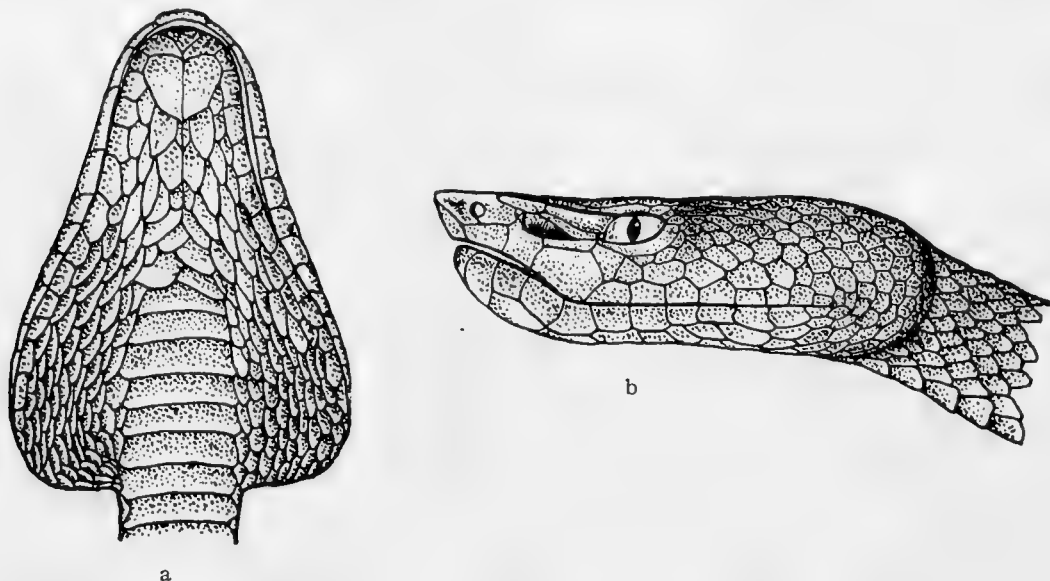


FIG. 77. *Trimeresurus stejnegeri stejnegeri*. Type.  $\times 2$ . a. Ventral view of head. b. Lateral view of head

in contact behind symphysial. Chin shields irregular, first pair enlarged. Anteriorly, mid-dorsal scales are about half as broad as they are posteriorly. With the exception of outer row on each side, scales are distinctly but obtusely keeled throughout, the keel traversing entire length of scale except on neck. Scale rows 21-19-17-15; reduction by loss of fifth row occurring approximately opposite 63d, 53d and 45th ventral plates, respectively, counted forward from anal; first count taken one head-length behind head. Ventrals 165. Anal entire. Caudals 62, divided. Snout to vent 577 mm. Tail 111 mm.

Color uniform green above, somewhat lighter green below. A narrow, yellowish lateral stripe along the middle of the first scale row; this stripe stops on neck anteriorly and a little beyond vent posteriorly. Tip of tail pale reddish. Head without pattern or postocular stripe.

The hemipenis extends to the thirteenth to fourteenth subcaudal plates and is forked opposite the ninth to tenth. It is spinous proximally, calyculate distally, the calyculate area being much less extensive than, and noticeably encroached upon by, the spinous one. Six large spines, each with a 2.5 to 3 mm. free end, arise abreast of one another near the base of the organ and some distance proximal to the point of forking. Distal to these, a few scattered smaller ones of varied sizes are found, some in each fork. The calyces are small, without scalloped edges, and uniform in size and structure. They arise immediately distal to the point of forking. The sulcus branches opposite the tips of the six



large spines and is not prominent. Its lips are devoid of spines and calyces. The base of the hemipenis, proximal to the large spines, is beset with very minute ones. (Description based on a specimen from Chungan Hsien.)

In 1933 (No. 620, p. 6), Pope and Pope stated that the organ forks opposite the seventh to eighth subcaudal plates, but the specimen then described (American Museum No. 33225) is not fully mature. Moreover, it is from Yenping, not Chungan Hsien. The extremely spinous nature of the *stejnegeri* hemipenis is so marked that impressions of the spines are readily seen through the walls of the undissected organ while still in the tail. This point is of practical as well as theoretical interest because it allows *stejnegeri* to be distinguished from *albolabris* as quickly and easily by hemipenial as by scale characters and refutes the general belief that the hemipenis is impractical for use in general identification.

*Distribution*.—*T. s. stejnegeri* is known from the following localities in China:

Kwangsi: Kuchen.

Kwangtung: mountains of north near the Hunan and Kiangsi boundaries, including Wanszushan.

Hainan: (no specific locality).

Hunan: Taolin.

Fukien: Futsing Hsien; Yenping; Shaowu; Chungan Hsien (including Kuatun).

Chekiang: Tunglu; Ningpo region; Mokanshan.

A specimen in the Naturhistorisches Museum, Vienna, labeled "Annam, Tonkin," may be taken as evidence that typical *stejnegeri* extends its range southward at least as far as Tongking. It is abundant on Formosa where Maki (1931, pp. 212, 214 and probably 216) has named two forms, *formosensis* and *kodairai*, differing from *stejnegeri* only in coloration. The first of his new subspecies is obviously male *stejnegeri*, the second possibly a color variant of the same species. One of my Fukien specimens has a very weak lateral stripe. Men working on abundant material from a very small area almost invariably tend to "split" in this manner.

*Habits and Habitat*.—Typical *stejnegeri* is an arboreal (Mell, 1929, p. 250, and Werner, 1924, p. 49) mountain inhabitant. Mell (1922, p. 127) gives its vertical range in northern Kwangtung as 500 to 900 meters, but it certainly descends to lower levels than this in the mountains of Futsing Hsien.

The following account of this snake (Pope, 1929, p. 481) gives many details of interest:

These snakes may be found in abundance at night in the cascading streams of the high mountains about Kuatun. On three occasions I found them prowling among the boulders lying in stream beds. One night two were seen. This is especially significant because in all my hunting in China I never found one anywhere else. A reliable collector reported killing

four one night. They probably go to the streams in search of frogs. One of those I found had just eaten a species of *Rana*, and another speedily swallowed a small *Megalophrys* that I gave it. The stomachs of four of the preserved series contain frog, 1 rat, and 1 shrew remains.

When surprised at night this snake not only strikes viciously but often violently thrashes the entire posterior end of its body about in a most surprising fashion. A Chinese used to bring these snakes to me, carrying them in his bare hands. I watched him more than once and can only conclude that, like certain other snakes, these vipers do not always bite objects actually attached to them but rather strike anything waved in front of them. This same man insisted that these snakes would remain hanging from a peg "overnight." We experimented and found that they will remain thus suspended for minutes at a time apparently reluctant to drop to the ground. This is an indication of arboreal habits.

On August 3, at Wanszushan, Mell (1922, p. 128) secured a female measuring 695 mm. and containing three 150 mm., advanced embryos. He also reported another lot of 3 late embryos and thus established the ovoviviparous habits of this pit-viper. A Yenping female in the American Museum, almost certainly collected between April 12 and June 2 (very improbably between July 29 and August 6), contains 4 eggs, one of which measures 22 x 12 mm. These are evidently in an earlier stage of development than I formerly thought them to be (1929, p. 482), because no embryo can be made out by gross examination. The Futsing paratype of *stejnegeri* was collected July 10, measures 585 mm. in total length, and holds 5 scaled, weakly pigmented embryos one of which measures 130 mm. It is extremely interesting to note that an egg-tooth can be detected on the most advanced of these embryos.

*Material examined*:—I have seen the following material from China: the type from Shaowu, 1 paratype from Futsing and another without definite locality, 7 specimens from Futsing Hsien, 11 from Yenping, and 28 from Chung-an Hsien, in the American Museum; 1 from Tunglu, in the Museum of Comparative Zoölogy; 1 from Kuatun and 2 from Mokanshan, in the U. S. National Museum; 1 from Kuatun and 1 from the Ningpo region, in the British Museum; 1 from Hainan, in the Senckenbergisches Museum, Frankfurt; 1 from Taolin, in the Naturhistorisches Museum, Vienna; and 6 from Kwangtung, in the Berlin Museum.

*Remarks*:—In comparing *stejnegeri* with *albolabris*, three characters possibly correlated with terrestrial and arboreal habits deserve mention:

1. The green belly of the arboreal *stejnegeri* may well serve to render it inconspicuous from below to enemies or prey. On the other hand, a green ventrum in *albolabris* could scarcely have survival value.
2. The prehensile tail of *stejnegeri* has much less sexual difference in subcaudal counts than the non-prehensile one of *albolabris*. Perhaps this usual difference has been reduced in *stejnegeri* where a valuable function would be handicapped by its marked development in the female. The proportionate tail length in the sexes would of course be roughly indicated by the subcaudal counts.

3. A high development of hemipenial spines might well be advantageous to arboreal snakes because a sexual embrace can scarcely be as readily accomplished and as easily maintained in a bush as on the ground.

The synonymy given above includes all the references in the literature that are certainly based upon material of *stejnegeri*. Many additional ones have been omitted due to the impossibility of telling whether they refer to *albolabris* or to *stejnegeri*.

130. *Trimeresurus stejnegeri yunnanensis* Schmidt

*Lachesis gramineus gramineus* Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 127 (part: Tali, Yunnan, 2000-2300 meters).

*Trimeresurus yunnanensis* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 4 (type locality, Tengyueh, Yunnan); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 547 (amplified description of type; paratypes recorded from the type locality, Yunnanfu and Luchuan, Yunnan).

*Trimeresurus gramineus yunnanensis* Stejneger, 1927, Proc. U. S. Nat. Mus., LXXII, Art. 19, p. 10.—Mell, 1931, Lingnan Sci. Journ., VIII, p. 218.

*Trimeresurus stejnegeri* Pope and Pope, 1933, Amer. Mus. Novitates, No. 620, pp. 2 and 5 (part: Mogok; Shillong; Himalayas; Sikkim Himalayas).

*Description*.—There is little need for a formal description of this subspecies since it differs from the typical form only in having fewer (19) scale rows and a lower ventral count. Table LVIII well illustrates these points.

TABLE LVIII. VENTRAL, SUBCAUDAL AND SCALE ROW COUNTS OF *TRIMERESURUS STEJNEGERI YUNNANENSIS*

Locality	Sex	Number of Scale Rows on Neck, at Midbody and Before Vent	Ventrals	Subcaudals	Material or Museum
Tengyueh.....	♂	19-19-15	156	67	type
Tengyueh.....	♀	19-19-15	157	39+	paratype
Yunnanfu.....	♂	21-19-15	160	68	paratype in Mus. Comp. Zool.
Luchuan.....	♀	21-19-15	163	64	paratype in Mus. Comp. Zool.
Mogok.....	♂	21-19-15	159	65	British Museum
Shillong.....	♂	21-21-15	158	64	British Museum
Himalayas.....	♂	21-19-15	155	64	British Museum
Sikkim Himalayas...	♂	21-19-13(14)	157	58(+?)	British Museum

Two Tengyueh paratypes unavailable to me evidently had not more than 160 nor less than 155 ventrals and 19 scale rows at midbody (Schmidt, 1927

p. 548), while it may be concluded that three Tali specimens collected by Mell (1922, p. 127) and now in the Berlin Museum fall within the 155-163 ventral range of *yunnanensis* given by him in 1931 (p. 218).

Examination of forty-eight Fukien *stejnegeri* in the American Museum fails to reveal a single one with 19 scale rows at midbody, so there is little reason to doubt the validity of *yunnanensis* even though an occasional individual from Yunnan or even farther west has 21. Re-examination of the type and one Tengyueh paratype shows that a count of 21 can be made only very close to the head, nearer to it than I am accustomed to make my anterior count, and it is for this reason that I have put 19-19-15 instead of 21-19-15 for these two specimens in the table. This point is of more than casual interest because it indicates that *yunnanensis* has actually dropped two rows on its neck, not merely lost them just anterior to midbody. A detailed comparison of additional western material will serve to establish this point more fully, and no doubt a second and more critical study of other specimens whose formulas are given in the table as 21-19-15 would result in their being changed to 19-19-15 as well.

The hemipenis of *yunnanensis* is essentially like that of typical *stejnegeri* from Fukien. This fact establishes their specific identity beyond doubt.

*Distribution*.—In China, *T. stejnegeri yunnanensis* is known only from Yunnanfu, Luchuan, Tali, and Tengyueh, Yunnan. It ranges westward as far as the Sikkim Himalayas.

*Habits and Habitat*.—Mell (1922, l.c.) found this form on bushes, inclined trees, and grass of the forest floor in western Yunnan, while the Luchuan paratype in the Museum of Comparative Zoölogy contains an advanced nestling timeliid, *Fulvetta vinipectus bieti*, in its stomach. Nothing else is known about the life history of *yunnanensis*.

*Material examined*.—I have seen all the specimens listed in the table; and 4 additional ones from Tali, in the Berlin Museum.

*Remarks*.—Although there can be no doubt that three very distinct forms of green *Trimeresurus* occur in Upper Burma (*yunnanensis*, *gramineus* and *albolabris*), their recognition is not always an easy matter, the difficulty being especially great in the case of female *stejnegeri* and *gramineus* (Pope and Pope, 1933, No. 620, p. 12). A thorough field study is much needed to throw additional light on this most complex group.

**PART III**

**RÉSUMÉ OF THE NATURAL HISTORY OF CHINESE SNAKES**

### PART III

#### RÉSUMÉ OF THE NATURAL HISTORY OF CHINESE SNAKES

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## CHAPTER VI

### ECOLOGY

#### HABITAT PREFERENCES OF SNAKES IN CHINA

TABLE LIX is intended to show in a general way the habitat preferences of snakes in China as described in detail under each species. It must not be forgotten, however, that most species are prone to wander a limited distance from a preferred habitat into almost any adjacent one. Therefore this table cannot always be interpreted literally.

In using this table certain facts should be kept in mind:

1. A ○ signifies that the habitat indicated is not the typical one for the species, but one frequented by it near the southern or northern extremity of its range, i.e., where increase or decrease in altitude produces climatic conditions approximating those of a more northern or southern latitude and thus fulfills the requirements of the species concerned.

2. The columns headed parenthetically "non-specific" (Nos. 7, 9, 15 and 16) have been introduced chiefly to be used: (1) for special emphasis, "E"; (2) when lack of information does not warrant complete, more nearly complete, or more accurate classification, "I"; (3) to indicate less pronounced or secondary habitat preferences, "L."

3. As a rule only well-established habitat preferences and tendencies have been included here, while data based on observations not actually made in China have been used to a limited degree only.

4. Forest-loving snakes may persist for some time in a region after it has been deforested. Accurate data on this point for regions now undergoing deforestation might have great value and therefore all records for such regions would be of interest. They might also show how rapidly species from surrounding sections already long devoid of trees occupy one only recently deforested.

5. *Natrix ornaticeps*, *N. popei*, *Pseudoxenodon dorsalis* and *Elaphe perlacea* are not included in the table because information on their habits is either lacking or confusing.

## THE REPTILES OF CHINA

TABLE LIX. HABITATS SUMMARIZED

[illegible]



TABLE LIX. HABITATS SUMMARIZED (Cont'd)

FORM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	AQUATIC	SEMI-AQUATIC						TERRESTRIAL								VERTICAL RANGE (non-specific)
		Running Water	Quiet Water			Secretive										
			Marshes, Ponds, Canals or Muddy Pools	Irrigated Fields	Irrigated Fields in Mountains											
Marine	Streams of Mountain Forests	Streams of Hills and Plains					Mountain Forests	Mountains (non-specific)	Level or Hilly Open Country	Mountains	Level or Hilly Open Country	Arboreal or Climbing Tendencies	Deserts and Semi-deserts	Low Altitudes	High Altitudes	
<i>Opisthotropis lateralis</i> . . . . .		X														
<i>Opisthotropis latouchii</i> . . . . .		X														
<i>Rhabdops bicolor</i> . . . . .									X							
<i>Trirhinopholis styani</i> . . . . .								X								
<i>Achalinus rufescens</i> . . . . .											X					
<i>Achalinus spinalis</i> . . . . .											X	○				
<i>Lycodon aulicus</i> . . . . .									X	X			X			
<i>Lycodon fasciatus</i> . . . . .									X				X			X
<i>Lycodon ruhstrati</i> . . . . .								X								
<i>Lycodon subcinctus</i> . . . . .									X	X					X	X
<i>Dinodon flavozonatum</i> . . . . .								X								
<i>Dinodon rufozonatum</i> . . . . .						L		X	X	X						
<i>Zaocys d. dhumnades</i> . . . . .									X	X						
<i>Zaocys d. montanus</i> . . . . .								X	X							
<i>Zaocys nigromarginatus</i> . . . . .																I
<i>Ptyas korros</i> . . . . .									L	X	X		L			
<i>Ptyas mucosus</i> . . . . .						L			X	X	X		X			
<i>Coluber spinalis</i> . . . . .										X	X			L		
<i>Elaphe bimaculata</i> . . . . .										X	X					
<i>Elaphe carinata</i> . . . . .								X	X	○						
<i>Elaphe davidi</i> . . . . .										X	X					
<i>Elaphe dione</i> . . . . .										X				X		
<i>Elaphe frenata</i> . . . . .								X								
<i>Elaphe mandarinus</i> . . . . .								X	X							
<i>Elaphe moellendorffi</i> . . . . .										X						
<i>Elaphe p. porphyracea</i> . . . . .																I
<i>Elaphe p. nigrofasciata</i> . . . . .								X	X							X
<i>Elaphe prasina</i> . . . . .									X							
<i>Elaphe radiata</i> . . . . .										X						
<i>Elaphe rufodorsata</i> . . . . .			X	X	X											
<i>Elaphe s. anomala</i> . . . . .								X	X	L	X		X			
<i>Elaphe tæniurus</i> . . . . .								X	X	X						
<i>Rhynchophis boulengeri</i> . . . . .								X		X						
<i>Dendrophis b. boiga</i> . . . . .										X			X			

TABLE LIX. HABITATS SUMMARIZED (Cont'd)

FORM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	AQUATIC	SEMI-AQUATIC						TERRESTRIAL								VERTICAL RANGE (non-specific)
		Running Water			Quiet Water						Secre- tive					
		Marine	Streams of Mountain Forests	Streams of Hills and Plains	Marshes, Ponds, Canals or Muddy Pools	Irrigated Fields	Irrigated Fields in Mountains								Water or Its Vicinity (non-specific)	
<i>Eurypholis doriae</i> . . . . .								X	I	O						
<i>Eurypholis major</i> . . . . .								X	X							
<i>Eurypholis multicinctus</i> . . . . .								X	X							
<i>Coronella bella</i> . . . . .								X								
<i>Holarchus chinensis</i> . . . . .								X		X						
<i>Holarchus formosanus</i> . . . . .									O	X						
<i>Holarchus violaceus</i> . . . . .										X						
<i>Oligodon eberhardti</i> . . . . .										X						
<i>Oligodon o. musyi</i> . . . . .								X	I							
<i>Calamaria p. pavimentata</i> . . . . .								X								I
<i>Calamaria septentrionalis</i> . . . . .											X	X				
<i>Enhydris bennettii</i> . . . . .							I									
<i>Enhydris chinensis</i> . . . . .				X	X											
<i>Enhydris enhydris</i> . . . . .			X	X	X											
<i>Enhydris plumbea</i> . . . . .				X	X											
<i>Chrysopelea ornata</i> . . . . .										X			X			
<i>Taphrometopon lineolatum</i> . . . . .										X				X		
<i>Ahaetulla prasina</i> . . . . .								X	X	X						
<i>Psammodynastes pulverulentus</i> . . . . .								X	X							
<i>Boiga kræpelini</i> . . . . .								X	X				X			
<i>Boiga multiomaculata</i> . . . . .										X						
<i>Bungarus fasciatus</i> . . . . .							L			X	X					L
<i>Bungarus m. multicinctus</i> . . . . .							L		X	X						
<i>Bungarus m. wanghaotingi</i> . . . . .									X	X						
<i>Calliophis maccllellandi</i> . . . . .								X	X	O						
<i>Hemibungarus kelloggi</i> . . . . .								X	X							
<i>Naja hannah</i> . . . . .								X	X	X						
<i>Naja naja atra</i> . . . . .								X	X	X						
<i>Hydrophiidæ</i> , all species . . . . .	X							L	X	X						
<i>Amblycephalus boulengeri</i> . . . . .									I							
<i>Amblycephalus chinensis</i> . . . . .								X	X							
<i>Amblycephalus kuangtungensis</i> . . . . .								X								
<i>Amblycephalus moellendorffi</i> . . . . .									X							
<i>Amblycephalus niger</i> . . . . .										X						I

TABLE LIX. HABITATS SUMMARIZED (Cont'd)

FORM	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
	AQUATIC	SEMI-AQUATIC						TERRESTRIAL								VERTICAL RANGE (non-specific)		
		Running Water			Quiet Water													
		Marine	Streams of Mountain Forests	Streams of Hills and Plains	Marshes, Ponds, Canals or Muddy Pools	Irrigated Fields	Irrigated Fields in Mountains	Water or Its Vicinity (non-specific)	Mountain Forests	Mountains (non-specific)	Level or Hilly Open Country	Mountains	Level or Hilly Open Country	Arboreal or Climbing Tendencies	Deserts and Semi-deserts		Low Altitudes	High Altitudes
<i>Amblycephalus stanleyi</i> . . . . .								X										
<i>Amblycephalus tonkinensis</i> . . . . .									X									
<i>Amblycephalus yunnanensis</i> . . . . .																I		
<i>Azemioops feae</i> . . . . .									X	O								
<i>Vipera r. siamensis</i> . . . . .										X								
<i>Agkistrodon acutus</i> . . . . .								X	X									
<i>Agkistrodon halys</i> . . . . .								X	X	X								
<i>Agkistrodon monticola</i> . . . . .								X								E		
<i>Agkistrodon strauchi</i> . . . . .									X							E		
<i>Trimeresurus albolabris</i> . . . . .										X								
<i>Trimeresurus jerdonii</i> . . . . .								X	X									
<i>Trimeresurus monticola</i> . . . . .								X	X									
<i>Trimeresurus mucrosquamatus</i> . . . . .								X	X				X					
<i>Trimeresurus s. stejnegeri</i> . . . . .						L		X	X				X					
<i>Trimeresurus s. yunnanensis</i> . . . . .													X			I		

FEEDING HABITS OF CHINESE SNAKES

The following broad conclusions may be drawn from a study of Tables LX and LXI:

1. Chinese snakes are specialized in feeding habits, the majority of forms subsisting on not more than three kinds of animals, while a considerable number show a marked preference for a single kind.
2. Vertebrates are eaten by most Chinese snakes, invertebrates by a few. Frogs (including toads), lizards and mammals form the basis of ophidian diet.
3. Most snakes have no marked economic value. Species of *Elaphe*, *Agkistrodon* and *Trimeresurus* consume large numbers of rodents and are therefore useful. Unfortunately, species of the last two genera are poisonous enough to be dangerous to man and thus offset the good they do.



		Scale Rows	Insects	Spiders	Whip-scorpions	Crustaceans	Earthworms	Slugs and Snails	Eels and Loaches (specific)	Fishes (non-specific)	Salentia (adult)	Tadpoles (Salientia)	Lizards	Snakes	Reptile Eggs	Birds	Mammals	Columns Checked
Achalinus spinalis . . . . .	23	.	.	.	.	X	.	.	.	.	X	.	X	.	.	.	.	1
Lycodon a. aulicus . . . . .	17	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	.	2
Lycodon fasciatus . . . . .	17	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	1
Lycodon ruhstrati . . . . .	17	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	1
Lycodon subcinctus . . . . .	17	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	1
Dinodon flavozonatum . . . . .	17	.	.	.	.	.	.	.	X	X	X	.	X	X	.	.	.	2
Dinodon rufozonatum . . . . .	17	.	.	.	.	.	.	.	X	X	X	.	X	X	.	.	.	5
Zaocys d. dhumnades . . . . .	16	.	.	.	.	.	.	.	.	X	X	.	.	.	.	.	.	1
Zaocys d. montanus . . . . .	16	.	.	.	.	.	.	.	.	X	X	.	.	.	.	.	.	1
Ptyas korros . . . . .	13	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	.	2
Ptyas mucosus . . . . .	17	.	.	.	.	.	.	.	.	.	X	.	X	X	.	X	X	5
Coluber spinalis . . . . .	17	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	1
Elaphe bimaculata . . . . .	25	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	X	2
Elaphe carinata . . . . .	23	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	.	3
Elaphe davidi . . . . .	23	.	.	.	.	.	.	.	.	.	.	.	X	X	.	.	.	1
Elaphe dione . . . . .	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	2
Elaphe mandarinus . . . . .	23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	1
Elaphe p. porphyracea . . . . .	19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	1
Elaphe p. nigrofasciata . . . . .	19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	1
Elaphe radiata . . . . .	19	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	1
Elaphe rufodorsata . . . . .	21	.	.	.	.	.	.	X	.	.	X	.	.	.	.	.	.	2
Elaphe s. anomala . . . . .	23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	1
Elaphe tæniurus . . . . .	25	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	1
Dendrophis b. boiga . . . . .	15	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	.	2
Eurypholis major . . . . .	15	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	.	1
Holarachus formosanus . . . . .	19	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	1
Holarachus violaceus . . . . .	17	X	X	X	.	.	.	.	.	.	.	.	.	.	.	.	.	3
Oligodon o. musyi . . . . .	15	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	1
Enhydris chinensis . . . . .	23	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	1
Enhydris enhydris . . . . .	21	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	.	1
Enhydris plumbea . . . . .	19	.	.	.	.	.	.	.	.	.	X	.	.	.	.	.	.	1
Chrysopelea ornata . . . . .	17	.	.	.	.	.	.	.	.	.	.	.	X	X	.	.	X	3
Taphrometopon lineolatum . . . . .	17	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	.	1
Ahætulla prasina . . . . .	15	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	.	2
Psammodynastes pulverulentus . . . . .	17	.	.	.	.	.	.	.	.	.	X	.	X	.	.	.	.	2
Boiga kräpelini . . . . .	21	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	1
Boiga multomaculata . . . . .	19	.	.	.	.	.	.	.	.	.	.	.	X	.	.	X	.	2
Bungarus fasciatus . . . . .	15	.	.	.	.	.	.	.	.	.	.	.	X	X	X	.	.	3
Bungarus m. multicinctus . . . . .	15	.	.	.	.	.	.	.	.	.	.	.	.	X	.	.	.	1
Bungarus m. wanghaotingi . . . . .	1																	

TABLE LX. FOOD PREFERENCES OF CHINESE SNAKES (Cont'd)

FORM	Scale Rows	Insects	Spiders	Whip-scorpions	Crustaceans	Earthworms	Slugs and Snails	Eels and Loaches (specific)	Fishes (non-specific)	Salientia (adult)	Tadpoles (Salientia)	Lizards	Snakes	Reptile Eggs	Birds	Mammals	Columns Checked
<i>Amblycephalus moellen-</i> <i>dorffi</i> . . . . .	15	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	1
<i>Amblycephalus stanleyi</i> . . . . .	15	.	.	.	.	.	X	.	.	.	.	.	.	.	.	.	1
<i>Agkistrodon acutus</i> . . . . .	21	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	2
<i>Agkistrodon halys</i> . . . . .	21	.	.	.	.	.	.	.	.	X	.	X	.	.	.	X	3
<i>Trimeresurus albolabris</i> . . . . .	21	.	.	.	.	.	.	.	.	X	.	X	.	.	.	X	3
<i>Trimeresurus jerdonii</i> . . . . .	21	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	2
<i>Trimeresurus monticola</i> . . . . .	23	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X	1
<i>Trimeresurus mucrosqua-</i> <i>matus</i> . . . . .	25	.	.	.	.	.	.	.	.	.	.	.	.	.	X	X	2
<i>Trimeresurus s. stejnegeri</i> . . . . .	21	.	.	.	.	.	.	.	.	X	.	.	.	.	.	X	2
<i>Trimeresurus s. yunnan-</i> <i>ensis</i> . . . . .	19	.	.	.	.	.	.	.	.	.	.	.	.	.	X	.	1

Table LX may be summarized as follows:

TABLE LXI. FOODS SUMMARIZED

Kinds of Animals Eaten	Number of Ophidian Enemies
Whip-scorpion . . . . .	1
Insects . . . . .	2
Spiders . . . . .	2
Crustaceans . . . . .	2
Reptile Eggs . . . . .	3
Slugs and Snails . . . . .	4
Tadpoles (Salientia) . . . . .	4
Earthworms . . . . .	6
Eels and Loaches (specific) . . . . .	6
Fishes (non-specific) . . . . .	7
Birds . . . . .	9
Snakes . . . . .	12
Mammals . . . . .	21
Lizards . . . . .	25
Salientia (adult) . . . . .	32

#### REPRODUCTION

The table of breeding habits (Table LXII) summarizes nearly all the data recorded in detail under each species. In a few cases where the data are too

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## BREEDING HABITS OF CHINESE SNAKES

[illegible]



numerous to be entirely included, the reader is referred, in the last column, to the text where the missing information may be found. As a rule, doubtful or questioned points are omitted from the table. Small letters in parentheses indicate close relationship between the items that are similarly lettered and refer to the same species. For example, if a specimen of a certain species laid 12 eggs measuring 21-23 x 15-17 mm. at Kuatun on July 10, and these hatched there on September 10, columns 1, 6, 9, 10, 12, 13, 14 and 15 would be filled in and each item followed by the same small letter in parentheses. For practical reasons a few series of related data have not been fully correlated by letters, but their relationship has of course been indicated in the detailed treatment of the species in question.

The table as constructed is not complete, and in case future work is to be done on the breeding of Chinese snakes, columns should be added for copulation and parental care. In addition, it would be well to record the length of all parents whose offspring are either counted or measured, and, simply as a matter of routine, to include a date and locality with every class of data listed.

## CHAPTER VII

### SEXUAL CHARACTERS IN CHINESE SNAKES

#### INTRODUCTION

SEXUAL dimorphism in snakes has, as a rule, been given little attention by taxonomists. Table LXIII shows, however, that relatively few species are devoid of external sexual dimorphism of some kind or sexual difference in maximum size. Moreover, many of the forms not listed below are omitted only because of insufficient data and almost certainly would be included were more counts available. It should be noted that the Hydrophiidæ are left out entirely. Absence of crosses in columns 1-3 indicates that the data under these headings are incomplete or lacking.

As clearly demonstrated by the table, in the majority of species the female attains the greater size and has the higher ventral count, while the greater number of subcaudals is found in the male. The male usually has a tail longer in proportion to the total length than the female, but I have not taken up this point because it seems to be closely correlated with the higher subcaudal count of the former sex. It might be said that the greater size of the female is likewise correlated with its higher ventral count, but such does not appear to be the case, since the female of several species in which the males have higher ventral counts attains the greater maximum size. The female's excess in number of ventrals is relatively insignificant in comparison with her usual marked excess in maximum length, nor does the relatively longer tail of the male noticeably affect the relation of the maximum sizes of the sexes.

The foregoing discussion makes it quite evident that, contrary to Boulenger's (1913, p. 16) statement, ophidian sexual dimorphism in ventral and subcaudal counts is not simply the result of a shift in position of the vent. Moreover, such an assertion, right or wrong, explains nothing. Since it is a well known fact that large individual females usually produce more young than small ones of the same species, one may safely consider body length of greater importance to females than to males. Now, such length may be attained by an increase in maximum size or by development of more vertebræ and conse-

quently more ventrals. It is therefore not surprising to find maximum length of body as well as maximum ventral counts closely correlated with the female sex.

I have not considered many aspects of sexual dimorphism in counts and measurements that might well warrant attention. For instance, in some species one sex may be noticeably more variable in ventral or subcaudal counts than the other. Proper determination of such variations requires data based on very large numbers of accurately sexed specimens.

Finally, sexual dimorphism often furnishes valuable taxonomic characters. In fact, occasionally species cannot be readily distinguished until sexual differences have been taken into consideration, while a study of the table will clearly show that similar unusual kinds of sexual differences are generally found in species of the same genus, my former statement (1929, p. 362) notwithstanding. The higher ventral counts in males of *Opisthotropis* species serve as an illustration of the presence of unusual sexual dimorphism in forms of one genus.

Blanchard (1931, p. 95) has described sexual dimorphism in many American snakes. More recently, Noble has studied in detail the tubercles of the chin-shields and adjacent scales as well as the ridges and knobs of the sacral region ("supracloacal tubercles"). Unfortunately, his work is still unpublished, but the following abstract of the paper (1934, p. 3) read by him before the American Society of Zoölogists in December, 1933, gives his major conclusions:

In the adult males of many snakes a series of supracloacal tubercles appear on the sides while in a few water snakes (some *Natrix* and *Tapinophis*<sup>1</sup>) other tubercles are found on the chin. An histological examination of these structures reveals that they are formed by sense organs lying directly under the epidermis. Each organ consists of a capsule of irregularly arranged tactile cells and many nerve fibers. The organs of the chin differ radically from those above the cloaca in having one or more narrow extensions piercing the overlying epidermis to near the horny layer. In the males of many snakes which lack chin tubercles (*Thamnophis*, *Storeria*, etc.), the sense organs of the chin are represented only by the epidermal portions which both ontogenetically and phylogenetically are the precursors of the dermal sense organs of the chin. These epidermal organs are also present in the female where they presumably have general tactile functions.

Male *Thamnophis* will not court when their chins are covered with tape. Hence the chin organs of the male apparently aid in self stimulation. Males having the supracloacal organs taped will court but are unable to assume the correct mating posture. Taping covers the free-nerve terminations in the epidermis adjacent to the sense organs. These endings are large, knob-like and intracellular like those in the epidermal sense organs of the chin. This resemblance in form suggests that free-nerve endings of the epidermis may also have tactile functions in snakes.

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<sup>1</sup>*Opisthotropis latouchii* of this volume.

TABLE LXIII. SEXUAL DIMORPHISM IN CHINESE SNAKES

FORM	1		2		3		4	5	6	7
	Greater Size		Higher Ventral Count		Higher Subcaudal Count		Difference in Coloration	Male with Tubercular Head Scales	Cloacal Scales of Male Tuberculate, Ridged or with Knobbed Keels	Other Differences
	♂	♀	♂	♀	♂	♀				
<i>Sibynophis chinensis</i> . . . . .		X			X					
<i>Sibynophis collaris</i> . . . . .		X			X					
<i>Natrix aequifasciata</i> . . . . .		X			X			X		
<i>Natrix annularis</i> . . . . .		X	X		X		X	X		
<i>Natrix craspedogaster</i> . . . . .		X								
<i>Natrix nuchalis</i> . . . . .		X								
<i>Natrix octolineata</i> . . . . .					X					
<i>Natrix percarinata</i> . . . . .		X			X			X		
<i>Natrix piscator</i> . . . . .		X		X	X					
<i>Natrix sauteri</i> . . . . .					X					
<i>Natrix stolata</i> . . . . .		X								
<i>Natrix t. lateralis</i> . . . . .		X			X				X	
<i>Pseudoxenodon bambusicola</i> . . . . .				X	X		X			
<i>Pseudoxenodon fukienensis</i> . . . . .		X		X	X				X	
<i>Pseudoxenodon k. karlschmidti</i> . . . . .				X	X				X	
<i>Pseudoxenodon k. sinii</i> . . . . .					X					
<i>Pseudoxenodon m. macrops</i> . . . . .	X									
<i>Pseudoxenodon m. sinensis</i> . . . . .				X						
<i>Pseudoxenodon striaticaudatus</i> . . . . .	X			X	X				X	
<i>Macropisthodon rudis</i> . . . . .		X		X	X					
<i>Opisthotropis balteata</i> . . . . .		X	X		X					
<i>Opisthotropis kuatunensis</i> . . . . .			X					X	X	
<i>Opisthotropis lateralis</i> . . . . .			X							
<i>Opisthotropis latouchii</i> . . . . .		X	X		X			X		
<i>Rhabdops bicolor</i> . . . . .			X		X					
<i>Trirhinopholis styani</i> . . . . .		X		X	X				X	
<i>Achalinus rufescens</i> . . . . .				X	X					
<i>Achalinus spinalis</i> . . . . .		X		X	X					
<i>Lycodon aulicus</i> . . . . .		X								
<i>Lycodon ruhstrati</i> . . . . .					X					
<i>Dinodon flavozonatum</i> . . . . .	X									
<i>Dinodon rufozonatum</i> . . . . .					X					
<i>Ptyas korros</i> . . . . .	X									
<i>Ptyas mucosus</i> . . . . .	X									
<i>Coluber spinalis</i> . . . . .		X		X	X					
<i>Elaphe bimaculata</i> . . . . .				X	X					
<i>Elaphe carinata</i> . . . . .					X					
<i>Elaphe davidi</i> . . . . .				X	X					
<i>Elaphe dione</i> . . . . .		X		X	X					
<i>Elaphe radiata</i> . . . . .				X						

TABLE LXIII. SEXUAL DIMORPHISM IN CHINESE SNAKES (Cont'd)

FORM	1		2		3		4	5	6	7
	Greater Size		Higher Ventral Count		Higher Subcaudal Count		Difference in Coloration	Male with Tubercular Head Scales	Cloacal Scales of Male Tuberculate, Ridged or with Knobbed Keels	Other Differences
	♂	♀	♂	♀	♂	♀				
<i>Elaphe rufodorsata</i> . . . . .		X		X	X					
<i>Elaphe s. anomala</i> . . . . .				X	X					
<i>Elaphe tæniurus</i> . . . . .				X						
<i>Eurypholis major</i> . . . . .	X			X	X					
<i>Eurypholis multicinctus</i> . . . . .				X	X					
<i>Holarchus chinensis</i> . . . . .				X	X					
<i>Holarchus formosanus</i> . . . . .	X			X	X					
<i>Holarchus violaceus</i> . . . . .	X			X	X					
<i>Oligodon eberhardti</i> . . . . .				X						
<i>Oligodon o. musyi</i> . . . . .	X			X	X					
<i>Calamaria p. pavimentata</i> . . . . .				X	X					
<i>Calamaria septentrionalis</i> . . . . .		X		X	X					
<i>Enhydris bennettii</i> . . . . .			X		X					
<i>Enhydris chinensis</i> . . . . .		X	X		X			X	X	scales of tail tuberculate
<i>Enhydris plumbea</i> . . . . .		X			X			X	X	
<i>Ahaetulla prasina</i> . . . . .				X	X				X	
<i>Psammodynastes pulverulentus</i> . . . . .		X		X	X		X			
<i>Boiga multomaculata</i> . . . . .				X						
<i>Calliophis maccllellandi</i> . . . . .				X	X					
<i>Hemibungarus kelloggi</i> . . . . .				X						
<i>Naja hannah</i> . . . . .				X	X					
<i>Naja n. atra</i> . . . . .		X		X	X					
<i>Amblycephalus chinensis</i> . . . . .					X					
<i>Amblycephalus kuangtungensis</i> . . . . .					X					
<i>Amblycephalus moellendorffi</i> . . . . .				X	X			X		
<i>Amblycephalus stanleyi</i> . . . . .					X					
<i>Amblycephalus tonkinensis</i> . . . . .					X					
<i>Agkistrodon acutus</i> . . . . .				X	X					
<i>Agkistrodon halys</i> . . . . .		X		X	X					
<i>Agkistrodon strauchi</i> . . . . .				X						
<i>Trimeresurus albolabris</i> . . . . .		X		X	X		X			
<i>Trimeresurus monticola</i> . . . . .					X					
<i>Trimeresurus mucrosquamatus</i> . . . . .		X			X					
<i>Trimeresurus s. stejnegeri</i> . . . . .					X		X			
<i>Trimeresurus s. yunnanensis</i> . . . . .							X			
Totals . . . . .	9	28	8	39	56	0				
Percentages . . . . .	24	76	17	83	100	0				

# CHAPTER VIII

## MAXILLARY TEETH

### INTRODUCTION

TABLE LXIV brings together all the maxillary counts for which I can be held responsible, namely those that I have made, checked or supervised. The vast majority have either been done or confirmed by me personally. A minority of these counts are recorded under the descriptions of the various species, and in such cases, the proper page reference is given in the extreme right-hand column of the table. The last column also contains points of special interest as well as general ones not already brought out in the standard generic descriptions of Boulenger and other authors. A plus sign (+) in a maxillary count indicates an interval.

Even a limited experience in herpetology will suffice to convince one that great confusion exists over the maxillary counts of numerous common as well as rare species, and, in fact, the present work contains many corrections of erroneous counts now present in the literature. It is easy enough to ascertain the number of teeth a maxilla holds at the time of counting, but determination of the true count or full complement the bone is equipped to carry is quite another matter and can be accurately made out only by a careful scrutiny of empty sockets as well as teeth in situ. The table is an attempt to standardize the whole matter and put it on a firm foundation. It is to be hoped that other regional specialists will follow suit.

TABLE LXIV. MAXILLARY COUNTS OF CHINESE SNAKES

<i>Form</i>	<i>American Museum Number</i>	<i>Locality</i>	<i>Counts</i>	<i>Remarks</i>
<i>Python m. bivittatus</i>	27806	Hainan	17-18	
	27807	Hainan	17-18	
	27809	Hainan	18-18	
	27810	Hainan	18-18	
<i>Sibynophis chinensis</i>	34532	Chungan Hsien	38	all counts made on one side only; see p. 82
	34534	Chungan Hsien	40	
	34535	Chungan Hsien	42	
	34536	Chungan Hsien	37	
	34537	Chungan Hsien	41	
	34538	Chungan Hsien	36	

## MAXILLARY TEETH

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TABLE LXIV. MAXILLARY COUNTS OF CHINESE SNAKES (Cont'd)

<i>Form</i>	<i>American Museum Number</i>	<i>Locality</i>	<i>Counts</i>	<i>Remarks</i>
<i>Sibynophis collaris</i>	50801	Huton	45 or 46	count made on left side only; see p. 86
<i>Sibynophis grahami</i>	12804 18080	Wuting region Yunnanfu	44-46 42-?	see p. 88
<i>Natrix aequifasciata</i>	33814 33815 33817 33822	Futsing Hsien Futsing Hsien Futsing Hsien Futsing Hsien	25-26 28-26 26-26 28-27	
<i>Natrix annularis</i>	23525 24528 24597 24599	Wuhu Ningkwo Ningkwo Ningkwo	23-23 24-26 24-23 23-23	
<i>Natrix biteniata</i>	48468	Huton	22-21	
<i>Natrix craspedogaster</i>	33400 33402 33741 34549	Yenping Yenping Chungan Hsien Chungan Hsien	24-24 24-24 24-24 23-24	
<i>Natrix johannis</i>	12808 21076	Wuting region Yunnanfu	24-23 25-25	
<i>Natrix nuchalis</i>	17710 18079 21021 21025	20 miles north of Yunnanfu Yunnanfu Snow Mountain Likiang	22-21 20-21 19-20 18 or 19-19	No. 21021 is the type of <i>nivalis</i>
<i>Natrix octolineata</i>	13595 21024 21050 21051 35210	Tungchwan Likiang Tengyueh Tengyueh Hsinkai	24-24 25-25 24-25 23-23 26-27	No. 21051 is the type of <i>septemlineata</i>
<i>Natrix ornaticeps</i>	28255	Hainan	45	type of <i>andrewsi</i> ; see p. 115
<i>Natrix percarinata</i>	33368 34385 34406 34410	Yenping Chungan Hsien Chungan Hsien Chungan Hsien	31-31 30-31 29-30 32-31	
<i>Natrix piscator</i>	35076 35079 35232 35234	Hokow Hokow Yuankiang Yuankiang	26-26 26-26 25-25 24-23	

TABLE LXIV. MAXILLARY COUNTS OF CHINESE SNAKES (Cont'd)

<i>Form</i>	<i>American Museum Number</i>	<i>Locality</i>	<i>Counts</i>	<i>Remarks</i>
<i>Natrix popei</i>	27763 27765 27767	Nodoa Nodoa Nodoa	28-28 27-27 27-27	No. 27763 is the type; see p. 124
<i>Natrix stolata</i>	30007 30009 30018 33752 35146	Hainan Hainan Hainan Chungan Hsien Yenping	23+2-23+2 22+2-22+2 23+2-24+2 27+2-25+2 23+2-24+2	
<i>Natrix s. subminiata</i>	27759 27761	Nodoa Nodoa	23+2-22+2 21+2-?	
<i>Natrix s. helleri</i>	12807 21048 21049 23533 35238	Wuting region Yungchang Tengyueh Yenping Wuting Hsien	23+2-22+2 23+2-? 22+2-? 23+2-? 24+2-24+2	No. 21049 is the type; see p. 134
<i>Natrix t. lateralis</i>	28324 29473 29474	Chintzu Western Hills Western Hills	20+2-20+2 21+2-21+2 20+2-21+2	
<i>Pseudoxenodon bambusicola</i>	33407 34098 35143	Yenping Futsing Hsien Yenping	20+2-22+2 23+2-22+2 23+2-22+2	see p. 141
<i>Pseudoxenodon fukienensis</i>	34643 34650 34652	Chungan Hsien Chungan Hsien Chungan Hsien	21+2-21+2 22+2-22+2 21+2-21+2	No. 34650 is the type; see p. 145
<i>Pseudoxenodon k. karl- schmidtii</i>	34658 34659 34660	Chungan Hsien Chungan Hsien Chungan Hsien	26+2-26+2 26+2-26+2 27+2-26+2	No. 34658 is the type; see p. 148
<i>Pseudoxenodon k. sinii</i>		Chiufeng	26 or 27+2- 25 or 26+2	specimen in Berlin Mu- seum; see p. 150
<i>Pseudoxenodon m. sinensis</i>	12791 17401	near Yunnanfu 6 days north of Yunnanfu	21+2-22+2 19+2-19+2	see p. 155
<i>Pseudoxenodon striaticau- datus</i>	33759 34674 34675	Chungan Hsien Chungan Hsien Chungan Hsien	23+2-23+2 22+2-22+2 21+2-21+2	No. 33759 is the type; see p. 156



TABLE LXIV. MAXILLARY COUNTS OF CHINESE SNAKES (Cont'd)

<i>Form</i>	<i>American Museum Number</i>	<i>Locality</i>	<i>Counts</i>	<i>Remarks</i>
<i>Helicops yunnanensis</i>		Yunnan	24-24	teeth nearly equal but posterior ones slightly longer; cotype Indian Museum No. 4196; see p. 161
<i>Macropisthodon rudis</i>	34508 34509 34511 34520	Chungan Hsien Chungan Hsien Chungan Hsien Chungan Hsien	17-17 17-17 16-17 14-15	
<i>Opisthotropis andersonii</i>		Hongkong	22	type; see p. 166
<i>Opisthotropis balteata</i>	27751 27752	Nodoa Nodoa	21-21 21-20	see p. 168
<i>Opisthotropis kuatunensis</i>	33708 34434 34437	Chungan Hsien Chungan Hsien Chungan Hsien	38-39 39-42 36-36	No. 34437 is the type; see p. 170
<i>Opisthotropis lateralis</i>		Manson Mts. Yaoshan	27 about 27	type of <i>O. lateralis</i> and type or paratype of <i>T. shini</i> ; see pp. 171, 172
<i>Opisthotropis latouchii</i>	33295 33299 33711	Yenping Yenping Chungan Hsien	24-25 23-24 25-25	see p. 174
<i>Opisthotropis maxwelli</i>		southern Fukien	22 or 23	type; see p. 176
<i>Trirhinopholis styani</i>	34629 34631 34633 34634	Chungan Hsien Chungan Hsien Chungan Hsien Chungan Hsien	18-18 21-20 18-19 21-20	
<i>Achalinus rufescens</i>		Hongkong	29	see p. 183
<i>Achalinus spinalis</i>	33751 34614 34617 34622	Chungan Hsien Chungan Hsien Chungan Hsien Chungan Hsien	24-24 24-24 25-25 26-26	
<i>Lycodon fasciatus</i>	12799 35209	Yunnanfu Yunnanfu	7+2+2-7+2+? 7+2+2-7+2+2	see p. 188

TABLE LXIV. MAXILLARY COUNTS OF CHINESE SNAKES (Cont'd)

Form	American Museum Number	Locality	Counts	Remarks
<i>Lycodon ruhstrati</i>	34105	Futsing Hsien	7+3+2-7+3+2	No. 34106 is the type of <i>D.</i> <i>futsingensis</i> ; see p. 193
	34106	Futsing Hsien	7+3+2-7+3+2	
	34584	Chungan Hsien	7+3+2-7+3+2	
	34585	Chungan Hsien	7+3+2-7+3+2	
	34586	Chungan Hsien	7+3+2-7+3+2	
<i>Dinodon flavozonatum</i>	34370	Chungan Hsien	7+3+3-7+3+3	see p. 199
	34372	Chungan Hsien	6+4+3-7+3+3	
	34373	Chungan Hsien	6+4+3-6+4+3	
	34375	Chungan Hsien	7+3+3-7+3+3	
<i>Dinodon rufozonatum</i>	17454	Changsha	6+3+3-6+3+3	see p. 204
	17455	Changsha	7+3+3-7+3+3	
	29392	Western Hills	6+3+3-6+3+3	
	29393	Western Hills	6+3+3-6+3+3	
<i>Zaocys d. dhumnades</i>	24514	Ningkwo	27-26	
	24516	Ningkwo	26-25	
<i>Zaocys d. montanus</i>	33242	Yenping	25-25	No. 34334 is the type
	34334	Chungan Hsien	26-25	
<i>Zaocys nigromarginatus</i>	17707	20 miles north of Yunnanfu	20-21	
	21001	Tengyueh	25-25	
	21002	Tengyueh	25-25	
<i>Ptyas korros</i>	27816	Nodoa	25-25	
	27817	Nodoa	25-24	
	33946	Futsing Hsien	26-26	
	33947	Futsing Hsien	26-27	
<i>Ptyas mucosus</i>	27826	Nodoa	22-21	
	27828	Nodoa	21-21	
	33241	Yenping	22-22	
	33244	Yenping	21-21	
<i>Coluber spinalis</i>	23921	Maitaichao	12+2-12+2	
	28284	Sohuang	12+2-13+2	
	29728	Tsinan region	12+2-12+2	
<i>Elaphe bimaculata</i>	24549	Ningkwo	19-19	No. 24640 is the type
	24640	Ningkwo	18-18	
	50800	Wuchang	19-20	
	50802	Wuchang	18-19	
<i>Elaphe carinata</i>	21073	Tengyueh	16-16	No. 21073 is the type of <i>osborni</i>
	22702	Yunnanfu	16-16	
	33958	Futsing Hsien	17-17	
	34637	Chungan Hsien	17-18	
<i>Elaphe davidi</i>			16-15	specimen la- beled "Peking" (see p. 238)

TABLE LXIV. MAXILLARY COUNTS OF CHINESE SNAKES (Cont'd)

<i>Form</i>	<i>American Museum Number</i>	<i>Locality</i>	<i>Counts</i>	<i>Remarks</i>
<i>Elaphe dione</i>	21483 23932 28283 28310	Hsinglungshan Maitaichao 260 miles south- east of Sairusu Chintzu	17-17 15-15 16-15 16-17	
<i>Elaphe frenata</i>	33456 34355 34590 34591	Yenping Chungan Hsien Chungan Hsien Chungan Hsien	20-20 20-20 21-20 22-23	
<i>Elaphe mandarinus</i>	23504 33735 34504 34505	Yenchingkou Chungan Hsien Chungan Hsien Chungan Hsien	17-? 16-16 17-16 14-16	
<i>Elaphe p. porphyracea</i>	21067 22705	Tengyueh Yunnanfu	21-21 20-20	the posterior teeth are dis- tinctly but not greatly reduced in length
<i>Elaphe p. nigrofasciata</i>	27757 34498	Nodoa Chungan Hsien	22-24 21-20	the posterior teeth are dis- tinctly but not greatly reduced in length
<i>Elaphe radiata</i>	35237	Yuankiang	22-?	
<i>Elaphe rufodorsata</i>	17431 24639 29377 29465	Changsha Wuhu Peiping Western Hills	18-19 18-19 19-19 18-18	
<i>Elaphe s. anomala</i>	21485 21486 29388 29389	Hsinglungshan Hsinglungshan Western Hills Western Hills	18-17 19-18 18-18 19-18	
<i>Elaphe taniurus</i>	21003 23497 24567 27756	Tengyueh Yenchingkou Ningkwo Hainan	22-22 22-22 21-22 22-22	
<i>Dendrophis b. boiga</i>	21045 27754	Lungling Nodoa	20-20 24-25	

TABLE LXIV. MAXILLARY COUNTS OF CHINESE SNAKES (Cont'd)

Form	American Museum Number	Locality	Counts	Remarks
<i>Eurypholis major</i>	33425	Yenping	21-22	
	33429	Yenping	21-21	
	33445	Yenping	21-21	
	33634	Chungan Hsien	22-21	
<i>Holarchus chinensis</i>	25571	Ningkwo	9-9	a very short
	33403	Yenping	10-10	anterior
	34656	Chungan Hsien	9-10	edentulous
	35056	Hokow	10-9	space
<i>Holarchus formosanus</i>	33410	Yenping	10-10	a short anterior
	33758	Chungan Hsien	10-10	edentulous
	33812	Futsing Hsien	10-10	space
	27800	Nodoa	10-11	
<i>Holarchus violaceus</i>	21015	Yenping	12-12	no edentulous
	27876	Nodoa	12-12	space evident
	27898	Nodoa	13-12	anteriorly
	33808	Futsing Hsien	12-12	
<i>Oligodon o. musyi</i>	33754	Chungan Hsien	8-8	a moderately
	33756	Chungan Hsien	8-8	long anterior
	34593	Chungan Hsien	9-8	edentulous
	34594	Chungan Hsien	7-7	space
<i>Calamaria septentrionalis</i>	23535	Wuhu	8-8	
	24534	Wuhu	8-8	
	24535	Wuhu	8-8	
	33411	Yenping	8-8	
<i>Enhydryis chinensis</i>	27955	Nodoa	14+2-14+2	
	27961	Nodoa	14+2-14+2	
	33856	Futsing Hsien	11+2-12+2	
	33860	Futsing Hsien	14+2-14+2	
<i>Enhydryis plumbea</i>	28047	Nodoa	15+2-15+2	
	28054	Nodoa	15+2-15+2	
	33287	Yenping	15+2-15+2	
	33707	Chungan Hsien	15+2-15+2	
<i>Psammodynastes pulverulentus</i>	27782	Nodoa	5+5+2-5+5+2	
	27785	Nodoa	5+5+2-5+5+2	
	33798	Futsing Hsien	5+5+2-5+5+2	
<i>Boiga kræpelini</i>	34100	Futsing Hsien	11+3-11+3	
	34518	Chungan Hsien	11+3-11+3	
	34519	Chungan Hsien	12+3-12+3	
	34521	Yuanshan Hsien	11+3-11+3	
<i>Boiga multomaculata</i>	27859	Nodoa	12+2-11+2	
	27862	Nodoa	11+2-11+2	
	27865	Nodoa	11+2-11+2	

## CHAPTER IX

### LIST OF SPECIES AND SUBSPECIES BY PROVINCES<sup>1</sup>

ONLY species and subspecies whose presence in a province has been actually proved by an unquestionable record are included in this list.

#### ANHWEI

*Alligator sinensis*  
*Clemmys mutica*  
*Geoclemys reevesii*  
*Amyda sinensis*  
*Natrix annularis*  
*Natrix tigrina lateralis*  
*Trirhinopholis styani*  
*Dinodon rufozonatum*  
*Zaocys dhumnades dhumnades*

*Elaphe bimaculata*  
*Elaphe carinata*  
*Elaphe dione*  
*Elaphe rufodorsata*  
*Elaphe taniurus*  
*Holarchus chinensis*  
*Calamaria septentrionalis*  
*Agkistrodon halys*

#### CHEKIANG

*Alligator sinensis*  
*Caretta caretta olivacea*  
*Clemmys mutica*  
*Geoclemys reevesii*  
*Amyda sinensis*  
*Sibynophis chinensis*  
*Natrix annularis*  
*Natrix craspedogaster*  
*Natrix percarinata*  
*Natrix piscator*  
*Natrix stolata*  
*Natrix tigrina lateralis*  
*Pseudoxenodon dorsalis*  
*Trirhinopholis styani*  
*Achalinus spinalis*  
*Dinodon rufozonatum*  
*Zaocys dhumnades dhumnades*  
*Ptyas korros*  
*Ptyas mucosus*  
*Elaphe bimaculata*

*Elaphe carinata*  
*Elaphe mandarinus*  
*Elaphe porphyracea nigrofasciata*  
*Elaphe rufodorsata*  
*Elaphe taniurus*  
*Eurypholis major*  
*Holarchus chinensis*  
*Holarchus formosanus*  
*Calamaria septentrionalis*  
*Enhydrys chinensis*  
*Enhydrys plumbea*  
*Bungarus multicinctus multicinctus*  
*Naja naja atra*  
*Hydrophis cyanocinctus*  
*Hydrophis melanocephalus*  
*Agkistrodon acutus*  
*Agkistrodon halys*  
*Trimeresurus monticola*  
*Trimeresurus stejnegeri stejnegeri*

<sup>1</sup> Exclusive of Lizards.

## FUKIEN

*Dermochelys coriacea*  
*Platysternon megacephalum*  
*Clemmys bealei*  
*Geoclemys reevesii*  
*Ocadia sinensis*  
*Pelochelys bibroni*  
*Amyda sinensis*  
*Typhlops braminus*  
*Python molurus bivittatus*  
*Sibynophis chinensis*  
*Natrix aequifasciata*  
*Natrix annularis*  
*Natrix craspedogaster*  
*Natrix percarinata*  
*Natrix piscator*  
*Natrix sauteri*  
*Natrix stolata*  
*Natrix subminiata helleri*  
*Natrix tigrina lateralis*  
*Pseudoxenodon bambusicola*  
*Pseudoxenodon fukienensis*  
*Pseudoxenodon karlschmidti*  
*karlschmidti*  
*Pseudoxenodon striaticaudatus*  
*Macropisthodon rudis*  
*Opisthotropis kuatunensis*  
*Opisthotropis latouchii*  
*Opisthotropis maxwelli*  
*Trirhinopholis styani*  
*Achalinus rufescens*  
*Achalinus spinalis*  
*Lycodon aulicus aulicus*  
*Lycodon ruhstrati*  
*Lycodon subcinctus*  
*Dinodon flavozonatum*  
*Dinodon rufozonatum*  
*Zaocys dhumnades montanus*

*Ptyas korros*  
*Ptyas mucosus*  
*Elaphe carinata*  
*Elaphe frenata*  
*Elaphe mandarinus*  
*Elaphe porphyracea nigrofasciata*  
*Elaphe radiata*  
*Elaphe rufodorsata*  
*Elaphe taniurus*  
*Eurypholis major*  
*Coronella bella*  
*Holarchus chinensis*  
*Holarchus formosanus*  
*Holarchus violaceus*  
*Oligodon ornatus musyi*  
*Calamaria septentrionalis*  
*Enhydria chinensis*  
*Enhydria plumbea*  
*Chrysopelea ornata*  
*Psammodynastes pulverulentus*  
*Boiga kræpelini*  
*Boiga multomaculata*  
*Bungarus fasciatus*  
*Bungarus multicinctus multicinctus*  
*Calliophis maccllellandi*  
*Hemibungarus kelloggi*  
*Naja hannah*  
*Naja naja atra*  
*Hydrophis cyanocinctus*  
*Amblycephalus kuangtungensis*  
*Amblycephalus stanleyi*  
*Agkistrodon acutus*  
*Trimeresurus albolabris*  
*Trimeresurus monticola*  
*Trimeresurus mucrosquamatus*  
*Trimeresurus stejnegeri stejnegeri*

## HAINAN

*Eretmochelys imbricata*  
*Platysternon megacephalum*  
*Cyclemys mouhotii*  
*Cyclemys trifasciata*  
*Clemmys mutica*  
*Clemmys quadriocellata*  
*Ocadia sinensis*  
*Pelochelys bibroni*

*Amyda sinensis*  
*Amyda steindachneri*  
*Typhlops braminus*  
*Python molurus bivittatus*  
*Sibynophis chinensis*  
*Natrix aequifasciata*  
*Natrix chrysarga*  
*Natrix ornaticeps*

*Natrix percarinata*  
*Natrix piscator*  
*Natrix popei*  
*Natrix stolata*  
*Natrix subminiata subminiata*  
*Pseudoxenodon bambusicola*  
*Opisthotropis balteata*  
*Achalinus rufescens*  
*Lycodon subcinctus*  
*Ptyas korros*  
*Ptyas mucosus*  
*Elaphe porphyracea nigrofasciata*  
*Elaphe tæniurus*  
*Dendrophis boiga boiga*  
*Holarchus formosanus*  
*Holarchus violaceus*  
*Calamaria septentrionalis*

*Enhydris bennettii*  
*Enhydris chinensis*  
*Enhydris plumbea*  
*Psammodynastes pulverulentus*  
*Boiga multomaculata*  
*Bungarus multicinctus multicinctus*  
*Calliophis maclellandi*  
*Naja hannah*  
*Naja naja atra*  
*Thalassophina viperina*  
*Hydrophis cyanocinctus*  
*Pelamydrus platyrus*  
*Microcephalophis gracilis gracilis*  
*Amblycephalus moellendorffi*  
*Amblycephalus tonkinensis*  
*Trimeresurus albolabris*  
*Trimeresurus stejnegeri stejnegeri*

## HONAN

*Geoclemys reevesii*  
*Pseudocadia anyangensis*  
*Natrix tigrina lateralis*

*Coluber spinalis*  
*Elaphe dione*

## HOPEI

*Amyda sinensis*  
*Natrix tigrina lateralis*  
*Dinodon rufozonatum*  
*Coluber spinalis*

*Elaphe rufodorsata*  
*Elaphe schrenckii anomala*  
*Elaphe tæniurus*  
*Agkistrodon halys*

## HUNAN

*Cyclemys flavomarginata sinensis*  
*Geoclemys reevesii*  
*Amyda sinensis*  
*Sibynophis chinensis*  
*Natrix craspedogaster*  
*Dinodon rufozonatum*  
*Zaocys dhumnades montanus*  
*Ptyas korros*

*Elaphe tæniurus*  
*Eurypholis major*  
*Calamaria septentrionalis*  
*Bungarus multicinctus multicinctus*  
*Naja naja atra*  
*Agkistrodon acutus*  
*Agkistrodon halys*  
*Trimeresurus stejnegeri stejnegeri*

## HUPEH

*Geoclemys reevesii*  
*Amyda sinensis*  
*Sibynophis chinensis*  
*Natrix nuchalis*  
*Natrix percarinata*  
*Natrix tigrina lateralis*  
*Achalinus spinalis*  
*Dinodon rufozonatum*  
*Ptyas mucosus*

*Elaphe bimaculata*  
*Elaphe carinata*  
*Elaphe rufodorsata*  
*Eurypholis major*  
*Enhydris chinensis*  
*Bungarus multicinctus multicinctus*  
*Agkistrodon acutus*  
*Agkistrodon halys*  
*Trimeresurus jerdonii*

## KANSU AND NINGSIA

*Geoclemys reevesii*  
*Amyda sinensis*  
*Eryx miliaris roborowskii*  
*Natrix tigrina lateralis*

*Coluber spinalis*  
*Elaphe dione*  
*Taphrometopon lineolatum*  
*Agkistrodon halys*

## KIANGSI

*Alligator sinensis*  
*Geoclemys reevesii*  
*Amyda sinensis*  
*Typhlops braminus*  
*Natrix annularis*  
*Natrix craspedogaster*  
*Natrix percarinata*  
*Natrix piscator*  
*Natrix stolata*  
*Natrix tigrina lateralis*  
*Opisthotropis latouchii*  
*Trirhinopholis styani*  
*Achalinus spinalis*  
*Lycodon ruhstrati*  
*Dinodon rufozonatum*  
*Zaocys dhumnades dhumnades*  
*Ptyas korros*

*Ptyas mucosus*  
*Elaphe bimaculata*  
*Elaphe carinata*  
*Elaphe rufodorsata*  
*Elaphe tæniurus*  
*Eurypholis major*  
*Holarchus chinensis*  
*Holarchus formosanus*  
*Calamaria septentrionalis*  
*Enhydris chinensis*  
*Boiga kræpelini*  
*Boiga multomaculata*  
*Bungarus multicinctus multicinctus*  
*Calliophis maccllellandi*  
*Naja naja atra*  
*Azemiope feae*  
*Agkistrodon halys*

## KIANGSU

*Alligator sinensis*  
*Caretta caretta olivacea*  
*Clemmys mutica*  
*Geoclemys reevesii*  
*Amyda sinensis*  
*Sibynophis chinensis*  
*Natrix annularis*  
*Natrix tigrina lateralis*  
*Achalinus spinalis*  
*Dinodon rufozonatum*  
*Zaocys dhumnades dhumnades*

*Elaphe bimaculata*  
*Elaphe carinata*  
*Elaphe dione*  
*Elaphe rufodorsata*  
*Elaphe tæniurus*  
*Eurypholis major*  
*Holarchus chinensis*  
*Enhydris chinensis*  
*Hydrophis cyanocinctus*  
*Agkistrodon halys*

## KWANGSI

*Platysternon megacephalum*  
*Cyclemys trifasciata*  
*Geoemyda spengleri spengleri*  
*Clemmys quadriocellata*  
*Testudo elongata*  
*Amyda sinensis*  
*Amyda steindachneri*  
*Sibynophis chinensis*  
*Natrix aequifasciata*  
*Natrix ornaticeps*

*Natrix percarinata*  
*Natrix piscator*  
*Natrix popei*  
*Natrix sauteri*  
*Natrix stolata*  
*Natrix subminiata helleri*  
*Pseudoxenodon bambusicola*  
*Pseudoxenodon karlschmidti sinii*  
*Opisthotropis balteata*  
*Opisthotropis lateralis*



*Achalinus rufescens*  
*Zaocys dhumnades montanus*  
*Ptyas korros*  
*Ptyas mucosus*  
*Elaphe moellendorffi*  
*Elaphe porphyracea nigrofasciata*  
*Elaphe radiata*  
*Elaphe taniurus*  
*Rhynchophis boulengeri*  
*Eurypholis major*  
*Eurypholis multicinctus*  
*Holarchus chinensis*  
*Holarchus formosanus*  
*Oligodon eberhardti*  
*Calamaria pavimentata pavimentata*  
*Calamaria septentrionalis*

*Ahætulla prasina*  
*Psammodynastes pulverulentus*  
*Boiga kraepelini*  
*Boiga multomaculata*  
*Bungarus fasciatus*  
*Bungarus multicinctus multicinctus*  
*Calliophis maccllellandi*  
*Hemibungarus kelloggi*  
*Naja hannah*  
*Naja naja atra*  
*Amblycephalus kuangtungensis*  
*Amblycephalus moellendorffi*  
*Trimeresurus albolabris*  
*Trimeresurus mucrosquamatus*  
*Trimeresurus stejnegeri stejnegeri*

## KWANGTUNG (EXCLUSIVE OF HAINAN)

*Platysternon megacephalum*  
*Cyclemys trifasciata*  
*Geoemyda spengleri spengleri*  
*Clemmys quadriocellata*  
*Geoclemys kwangtungensis*  
*Geoclemys reevesii*  
*Ocadia sinensis*  
*Pelochelys bibroni*  
*Amyda sinensis*  
*Amyda steindachneri*  
*Typhlops braminus*  
*Python molurus bivittatus*  
*Xenopeltis unicolor*  
*Sibynophis chinensis*  
*Natrix aequifasciata*  
*Natrix craspedogaster*  
*Natrix percarinata*  
*Natrix piscator*  
*Natrix popei*  
*Natrix sauteri*  
*Natrix stolata*  
*Natrix subminiata helleri*  
*Pseudoxenodon bambusicola*  
*Pseudoxenodon karlschmidti sinii*  
*Opisthotropis balteata*  
*Opisthotropis latouchii*  
*Achalinus rufescens*  
*Lycodon ruhstrati*  
*Dinodon flavozonatum*

*Zaocys dhumnades montanus*  
*Ptyas korros*  
*Ptyas mucosus*  
*Elaphe carinata*  
*Elaphe frenata*  
*Elaphe mandarinus*  
*Elaphe moellendorffi*  
*Elaphe porphyracea nigrofasciata*  
*Elaphe radiata*  
*Elaphe taniurus*  
*Eurypholis major*  
*Holarchus chinensis*  
*Holarchus formosanus*  
*Holarchus violaceus*  
*Calamaria pavimentata pavimentata*  
*Calamaria septentrionalis*  
*Enhydris chinensis*  
*Enhydris plumbea*  
*Ahætulla prasina*  
*Psammodynastes pulverulentus*  
*Boiga multomaculata*  
*Bungarus fasciatus*  
*Bungarus multicinctus multicinctus*  
*Calliophis maccllellandi*  
*Naja hannah*  
*Naja naja atra*  
*Thalassophina viperina*  
*Hydrophis caerulescens*  
*Pelamydrus platurus*

*Amblycephalus kuangtungensis*  
*Amblycephalus moellendorffi*  
*Vipera russelii siamensis*  
*Agkistrodon acutus*

*Trimeresurus albolabris*  
*Trimeresurus mucrosquamatus*  
*Trimeresurus stejnegeri stejnegeri*

## KWEICHOW

*Amyda sinensis*  
*Sibynophis chinensis*  
*Natrix craspedogaster*  
*Natrix percarinata*  
*Natrix subminiata helleri*

*Natrix tigrina lateralis*  
*Elaphe mandarinus*  
*Elaphe tæniurus*  
*Amblycephalus boulengeri*

## SHANSI

*Amyda sinensis*  
*Natrix tigrina lateralis*  
*Dinodon rufozonatum*  
*Coluber spinalis*

*Elaphe dione*  
*Elaphe schrenckii anomala*  
*Agkistrodon halys*

## SHANTUNG

*Amyda sinensis*  
*Natrix tigrina lateralis*  
*Dinodon rufozonatum*  
*Coluber spinalis*  
*Elaphe dione*

*Elaphe rufodorsata*  
*Elaphe schrenckii anomala*  
*Hydrophis cærulescens*  
*Hydrophis ornatus ornatus*  
*Lapemis hardwickii*

## SHENSI

*Geoclemys reevesii*  
*Amyda sinensis*  
*Sibynophis chinensis*

*Natrix tigrina lateralis*  
*Elaphe dione*  
*Agkistrodon halys*

## SUIYUAN

*Amyda sinensis*  
*Natrix tigrina lateralis*

*Coluber spinalis*  
*Agkistrodon halys*

## SZECHWAN AND HSIKANG

*Geoclemys reevesii*  
*Amyda sinensis*  
*Sibynophis chinensis*  
*Natrix craspedogaster*  
*Natrix johannis*  
*Natrix nuchalis*  
*Natrix octolineata*  
*Natrix percarinata*  
*Natrix sauteri*  
*Natrix tigrina lateralis*  
*Pseudoxenodon macrops macrops*  
*Pseudoxenodon macrops sinensis*  
*Macropisthodon rudis*  
*Trirhinopholis styani*  
*Achalinus spinalis*

*Lycodon fasciatus*  
*Lycodon ruhstrati*  
*Dinodon rufozonatum*  
*Zaocys dhumnades montanus*  
*Zaocys nigromarginatus*  
*Ptyas mucosus*  
*Elaphe carinata*  
*Elaphe mandarinus*  
*Elaphe perlacea*  
*Elaphe porphyracea porphyracea*  
*Elaphe tæniurus*  
*Eurypholis major*  
*Calamaria pavementata pavementata*  
*Boiga kræpelini*  
*Amblycephalus boulengeri*

*Amblycephalus chinensis*  
*Azemiops feae*  
*Agkistrodon halys*  
*Agkistrodon strauchi*

*Trimeresurus jerdonii*  
*Trimeresurus monticola*  
*Trimeresurus mucrosquamatus*

## YUNNAN

*Cyclemys yunnanensis*  
*Amyda sinensis*  
*Python molurus bivittatus*  
*Sibynophis collaris*  
*Sibynophis grahami*  
*Natrix biteniata*  
*Natrix johannis*  
*Natrix nuchalis*  
*Natrix octolineata*  
*Natrix piscator*  
*Natrix stolata*  
*Natrix subminiata helleri*  
*Pseudoxenodon macrops macrops*  
*Pseudoxenodon macrops sinensis*  
*Helicops yunnanensis*  
*Macropisthodon rudis*  
*Rhabdops bicolor*  
*Lycodon aulicus aulicus*  
*Lycodon fasciatus*  
*Dinodon rufozonatum*  
*Zaocys nigromarginatus*

*Ptyas korros*  
*Ptyas mucosus*  
*Elaphe carinata*  
*Elaphe porphyracea porphyracea*  
*Elaphe prasina*  
*Elaphe radiata*  
*Elaphe taniurus*  
*Dendrophis boiga boiga*  
*Eurypholis doriae*  
*Holarchus chinensis*  
*Ahætulla prasina*  
*Psammodynastes pulverulentus*  
*Bungarus fasciatus*  
*Bungarus multicinctus wanghaotingi*  
*Amblycephalus niger*  
*Amblycephalus yunnanensis*  
*Agkistrodon monticola*  
*Trimeresurus jerdonii*  
*Trimeresurus monticola*  
*Trimeresurus stejnegeri yunnanensis*



**PART IV**  
**THE LIZARDS**

**PART IV**

**THE LIZARDS**

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# CHAPTER X

## ANNOTATED CHECK LIST OF CHINESE LIZARDS

### CLASSIFICATION

#### Class REPTILIA

#### Order SQUAMATA Oppel

#### Suborder SAURIA Macartney

#### KEY FOR IDENTIFICATION OF CHINESE FAMILIES

- I. No large symmetrical shields on dorsal surface of head
  - A. No movable eyelids (except in *Eublepharis lichtenfelderi* which is readily recognized by its short bulbous tail, lepidosis of fine granular scales mixed with numerous large tubercles, and general gecko-like appearance)..... *Gekkonidæ*
  - B. Movable eyelids
    - 1. Tongue long, deeply bifid; dorsal scales granular; size gigantic..... *Varanidæ*
    - 2. Tongue short, nicked or slightly incised anteriorly; size medium or small
      - a. Tail with two conspicuous crests above..... *Shinisauridæ*
      - b. Tail crestless or with a median dorsal crest..... *Agamidæ*
- II. Dorsal surface of head with large symmetrical shields
  - A. Limbs present
    - 1. Ventral scales squarish, sharply differentiated from those of sides; femoral or inguinal pores present..... *Lacertidæ*
    - 2. Ventral scales cycloid, resembling those of sides and back; femoral and inguinal pores absent..... *Scincidæ*
  - B. Limbs absent..... *Anguidæ*

### CHECK LIST

#### Family GEKKONIDÆ

#### KEY FOR IDENTIFICATION OF CHINESE GENERA

- I. No movable eyelids
  - A. Digits not expanded
    - 1. Digits granular inferiorly, strongly fringed laterally; dorsal scales large, imbricate..... *Teratoscincus*

2. Digits with a series of narrow transverse plates inferiorly, not fringed laterally; dorsal scales juxtaposed. . . . . *Alsophylax*
- B. Digits expanded proximal to distal joint which rises from extremity of the expanded part
1. All digits essentially alike in structure
- a. Body without lateral dermal expansion. . . . . *Hemidactylus*
- b. Body with lateral dermal expansion. . . . . *Cosymbotus*
2. Inner digit differing markedly from others in structure
- a. Inner digit well developed and expanded but without a joint rising from expansion
- (1) Infradigital lamellæ in a double series. . . . . *Peropus*
- (2) Infradigital lamellæ in a single series. . . . . *Gekko*
- b. Inner digit vestigial, not expanded. . . . . *Hemiphyllodactylus*
- II. Movable eyelids present. . . . . *Eublepharis*

### Genus *Teratoscincus*

Strauch, 1863, Bull. Acad. Imp. Sci. St. Pétersbourg, VI, p. 480.

Genotype, by monotypy, *T. keyserlingii* Strauch = *T. scincus* (Schlegel)

### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Large cycloid scales of back extending forward to line of anterior border of forelimbs. . . . . *przewalskii*
- II. Large cycloid scales of back extending forward to occiput. . . . . *scincus*

#### 1. *Teratoscincus przewalskii* Strauch

*Teratoscincus Przewalskii* Strauch, 1887, Mém. Acad. Imp. Sci. St. Pétersbourg, (7) XXXV, No. 2, p. 71.

*Type locality*:—Here restricted to the Oasis of Hami, Sinkiang.

*Distribution*:—China: Edsin Gol region in Ningsia from 40° 52' E. Long. to about 42° 15' N. Lat.

Widely distributed in Sinkiang and reported from Mongolia.

*Material examined*:—Edsin Gol region, 2 specimens; Kashgar, 3 specimens (British Museum).

#### 2. *Teratoscincus scincus* (Schlegel)

*Stenodactylus scincus* Schlegel, 1858, Handl. Dierk., II, p. 16.

*Teratoscincus scincus* Boulenger, 1885, Cat. Liz. Brit. Mus., I, p. 12, Pl. II.

*Teratoscincus roborowskii* Bedriaga, 1905, Ann. Mus. Zool. Acad. Sci. St. Pétersbourg, X, p. 159 (type locality, Oasis of Sachow, Kansu).

*Type locality*:—Ili River, central Asia.

*Distribution*:—China: Oasis of Sachow in Kansu.

Distributed from Persia eastward through Sinkiang.



Genus *Alsophylax*

Fitzinger, 1843, Syst. Rept., pp. 18 and 90.

Genotype, by original designation, *Gymnodactylus pipiens* Eichwald = *Lacerta pipiens* Pallas = *A. microtis* (Blanford)

3. *Alsophylax microtis* (Blanford)

*Gymnodactylus microtis* Blanford, 1875, Journ. Asiat. Soc. Bengal, XLIV, pt. 2, p. 193.

*Alsophylax microtis* Mertens and Müller, 1928, Abh. Senckenberg. Naturf. Ges., XLI, p. 24 (Pallas' specific name *pipiens* shown to be inapplicable to the present species).

Type locality:—Sinkiang.

Distribution:—China: Ningsia region in Ningsia.

Distributed westward from Ningsia through part of Mongolia and Sinkiang to the Caspian Sea and extreme eastern Europe east of the lower Volga.

Material examined:—Ningsia region, 1 specimen (U. S. National Museum).

Genus *Hemidactylus*

Oken, 1817, Isis, p. 1183.

Genotype, by subsequent designation, *Gecko tuberculeux* Daudin = *H. mabouia* (Moreau de Jonnés)

KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. More or less numerous large tubercles intermixed with dorsal scales; unregenerated tail rough above with transverse rows of large tubercles
  - A. Tubercles very large, crowded, separated from one another by spaces about equal to the diameters of the tubercles; numerous small tubercles present on head. . . . . *brookii*
  - B. Tubercles smaller, not crowded, sometimes sparse, nearly always separated by spaces equal to several diameters of a tubercle; head devoid of tubercles *frenatus*
- II. No large tubercles intermixed with dorsal scales; unregenerated tail smooth above without transverse rows of large tubercles
  - A. Unregenerated tail with conspicuous denticulate lateral edges. . . . . *garnotii*
  - B. Unregenerated tail without conspicuous denticulate lateral edges. . . *bowringii*

4. *Hemidactylus bowringii* (Gray)

*Doryura Bowringii* Gray, 1845, Cat. Liz. Brit. Mus., p. 156.

*Hemidactylus bowringii* Boulenger, 1885, Cat. Liz. Brit. Mus., I, p. 139, Pl. XII.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 479 (Yunnanfu).—Pope, 1929, LVIII, p. 369 (Yenping, Foochow and Futsing Hsien, Fukien).

Type locality:—Probably Hongkong or region of Hongkong.

Distribution:—China: Likang and Yunnanfu in Yunnan; mainland Kwangtung; Amoy, Futsing Hsien, Foochow and Yenping in Fukien.

Also known from the Riu Kiu Islands, Formosa, Hongkong, India and Burma.

Material examined:—Yunnanfu, 1 specimen; Yenping, 12 specimens; Foochow, 1 specimen; Futsing Hsien, 12 specimens (American Museum).

5. *Hemidactylus brookii* Gray

*Hemidactylus Brookii* Gray, 1845, Cat. Liz. Brit. Mus., p. 153.

*Type locality*:—Borneo.

*Distribution*:—China: Ningpo.

Recorded from Bhamo, Burma. Distributed from India and Assam southeastward into the East Indies. Also known from tropical Africa. It has been accidentally introduced into the West Indies.

*Material examined*:—Ningpo, 1 specimen; China, 1 specimen (British Museum).

*Remarks*:—Confirmation of the occurrence of this gecko in China would be most gratifying because it has not been secured in that country for so long. Parenti and Picaglia's 1886 (p. 37) record for Amoy possibly belongs here.

6. *Hemidactylus frenatus* Duméril and Bibron

*Hemidactylus frenatus* Duméril and Bibron, 1836, Erp. Gén., III, p. 366.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 409, fig. 9 (Nodoa, Hainan).—Pope, 1929, LVIII, p. 369 (Yuankiang, Yunnan).

*Type locality*:—Java.

*Distribution*:—China: Yuankiang in Yunnan; Hainan, Macao, Tinghushan, Canton, Lofaoshan and Swatow in Kwangtung.

Also recorded from the Pescadores and Riu Kiu Islands and Formosa. Widely distributed in southeastern Asia and the East Indies; known from Africa, Madagascar, many oceanic islands and even the New World.

*Material examined*:—Nodoa, large series; Yuankiang, 8 specimens (American Museum).

*Remarks*:—The type locality is hereby restricted to Java. Compare Stejneger, 1907, p. 172, *frenatus* synonymy.

7. *Hemidactylus garnotii* Duméril and Bibron

*Hemidactylus Garnotii* Duméril and Bibron, 1836, Erp. Gén., III, p. 368.

*Type locality*:—Tahiti.

*Distribution*:—China: Hainan.

Widely but sporadically distributed from Sikkim and Burma southeastward through the peninsula of southeastern Asia and the East Indies to islands of the South Seas. Recorded from Bhamo and other localities in the general Kachin Hills region of Burma; known from Tongking.

*Material examined*:—Hainan, 1 specimen; Bao-Ha, 1 specimen (British Museum).

Genus *Cosymbotus*

Fitzinger, 1843, Syst. Rept., pp. 19 and 104.

Genotype, by original designation, *Hemidactylus platyurus* Cuvier = *Stellio platyurus* Schneider

8. *Cosymbotus platyurus* (Schneider)

*Stellio platyurus* Schneider, 1792, Amphib. Physiol., II, p. 30.

*Cosymbotus platyurus* Stejneger, 1907, Herp. Japan, p. 178.

*Type locality*:—Unknown.

*Distribution*:—China: Lilong in Kwangtung.

Also known from the Bhamo District of Burma, Hongkong and Formosa. Widely distributed from India and Ceylon through the peninsula of southeastern Asia and the East Indies to New Guinea.

*Remarks*:—It would be gratifying to receive confirmation of the somewhat questionable Hongkong record. New material from China would likewise be most welcome.

Genus **Peropus**

Wiegmann, 1835, Nova Acta Acad. Leop. Carol., XVII, pt. 1, p. 238.

Genotype, by monotypy, *Hemidactylus mutilatus* Wiegmann

9. **Peropus mutilatus** (Wiegmann)

*Hemidactylus mutilatus* Wiegmann, 1834, Herp. Mex., I, p. 54.

*Peropus mutilatus* Girard, 1858, Herp. U. S. Expl. Exped., p. 277.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 412 (Hainan).

*Type locality*:—Manila, Philippine Islands.

*Distribution*:—China: Hainan.

Known from Formosa and the Riu Kiu Islands. Common at Bhamo in Burma not far from the Yunnan boundary. Widely distributed.

*Material examined*:—Hainan, 39 specimens (American Museum).

Genus **Hemiphyllodactylus**

Bleeker, 1860, Natur. Tijdschr. Ned.-Indië, XX, p. 327.

Genotype, by original designation, *H. typus* Bleeker

10. **Hemiphyllodactylus yunnanensis** (Boulenger)

*Gehyra yunnanensis* Boulenger, 1903, Ann. Mag. Nat. Hist., (7) XII, p. 429.

*Cainodactylus yunnanensis* Barbour, 1924, Occ. Papers Boston Soc. Nat. Hist., V, p. 134, fig. 1.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 479 (Yunnanfu).

*Hemiphyllodactylus yunnanensis* Smith, 1933, Rec. Ind. Mus., XXXV, p. 16.

*Type locality*:—Yunnanfu.

*Distribution*:—China: Tungchwan and Yunnanfu in Yunnan.

Also known from Lashio in Burma, and northern Laos.

*Material examined*:—I have seen the 2 cotypes in the British Museum, 9 topotypes in the American Museum and one topotype in the Museum of Comparative Zoölogy (No. 18967).

Genus **Gekko**

Laurenti, 1768, Syn. Rept., p. 43.

Genotype, by subsequent designation, *G. verticillatus* Laurenti=*G. gekko* (Linnæus)

KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Rostral not entering nostril; size large, adults measuring about 125 mm. from snout to vent..... *gekko*
- II. Rostral entering nostril; size medium, adult never approaching 125 mm. in length from snout to vent

## A. Toes devoid of webbing or with a mere trace of such

1. Dorsal tubercles numerous, sharply contrasting with scales in size and form, usually more or less evenly distributed on back and often present on occiput. . . . . *japonicus*
2. Dorsal tubercles less numerous, not always contrasting with scales in size and form, less evenly distributed on back and rarely present on occiput. . . . . *swinhonis*

## B. Toes distinctly webbed

1. Back devoid of tubercles; male with 9 to 11 preanal pores. . . . *subpalmatus*
2. Back with numerous tubercles; male with 17 or more preanal pores. . . . . *chinensis*

11. *Gekko chinensis* Gray

*Gekko Chinensis* Gray, 1842, Zool. Misc., p. 57.

*Gekko similignum* Smith, 1923, Journ. Nat. Hist. Soc. Siam, VI, p. 198, fig. 3 (type locality, Angmao near the Wuchih Mountains, Hainan).

*Type locality*.—Here fixed as Canton region since the type undoubtedly was secured there by Reeves. Gray merely wrote, "Inhabits China."

*Distribution*.—Hainan (Angmao), Canton region, Tinghushan, and Shiuchow in Kwangtung.

*Material examined*.—The type of *G. chinensis*; the type and paratype of *G. similignum* (British Museum). Shiuchow, 3 specimens (Berlin Museum). Foochow, 1 specimen (U. S. National Museum).

*Remarks*.—Stejneger (1932, Art. 3, pp. 1-8) first clarified the relationships of the confusing species of *Gekko* inhabiting southeastern China.

12. *Gekko gekko* (Linnaeus)

*Lacerta gekko* Linnaeus, 1758, Syst. Nat., Ed. 10, p. 205.

*Gekko gekko* Barbour, 1912, Mem. Mus. Comp. Zool., XLIV, p. 82.

*Gekko gekko* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 479 (Yunnanfu, possibly an error for Tongking).

*Type locality*.—"In Indiis."

*Distribution*.—China: Kwangtung; Yaoshan and Wuchow in Kwangsi. No fewer than two museums have received specimens labeled "Yunnanfu," but it is possible that these may have been sent into China from Indo-China.

Widely distributed from northeastern India and Burma southeastward through the peninsula of southeastern Asia into the East Indies; well known from Tongking and recorded from Bhamo.

*Material examined*.—China, 3 specimens, including the type of *Gekko reevesii*; Canton, 7 specimens (British Museum). Five specimens collected by John Graham and labeled Yunnanfu, 2 in the American Museum and 3 in the Museum of Comparative Zoölogy.

13. *Gekko japonicus* (Duméril and Bibron)

*Platydictylus Japonicus* Duméril and Bibron, 1836, Erp. Gén., III, p. 337.

*Gekko japonicus* Guenther, 1864, Rept. Brit. India, p. 103.

*Gekko japonicus* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 477 (part: Yenping, Fukien; Ningkwö, Anhwei; Changsha, Hunan).

*Gekko japonicus hokouensis* Pope, 1928, Amer. Mus. Novitates, No. 325, p. 1 (type locality, Hokow, Kiangsi); 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 365, fig. 1 (amplified description; paratype recorded from Chungan City, Fukien).

*Type locality*:—Japan.

*Distribution*:—China: *G. japonicus* is undoubtedly the common gecko of central China where it ranges from eastern Szechwan through Hupeh and Hunan to the sea.

Due to the difficulty of distinguishing it from *swinhonis*, many existing records of both are unreliable and the listing of published localities a dangerous procedure. Moreover, *japonicus* has not only been confused with *swinhonis* but with *chinensis* as well.

Also known from Formosa, the Riu Kiu Islands and Japan.

*Material examined*:—Yenping, 1 specimen; Chungan City, 1 specimen; Hokow, 14 specimens; Ningkwo, 32 specimens; Changsha, 6 specimens (American Museum).

*Remarks*:—Although it is doubtful that *japonicus* and *swinhonis* can always be identified when examined apart, the following comparisons should greatly facilitate the separation of the two species when both are included in a single lot:

1. The toes of *japonicus* have only the rudiment of a web; those of *swinhonis* are entirely devoid of webbing.

2. In *japonicus*, the dorsal tubercles are relatively homogeneous, sharply contrasting with the scales in size and form, while in *swinhonis*, these tubercles are much less homogeneous and frequently appear to be merely enlarged scales. In the former species, the tubercles, often present on the occiput, are relatively numerous and evenly distributed.

3. The scales of *swinhonis* are coarser and less numerous than those of *japonicus*. This is especially noticeable on the head and anterior throat.

4. Magnification of a few diameters usually reveals a network of black lines (interscale skin) extending between the scales of adult *swinhonis*; such lines are never evident in *japonicus*.

5. The chin-shields of *japonicus* are nearly always longer and more symmetrically developed than those of *swinhonis*.

#### 14. *Gekko subpalmatus* Guenther

*Gekko subpalmatus* Guenther, 1864, Rept. Brit. India, p. 104, Pl. XII.

*Gekko melli* Vogt, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 136.—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 111, Pl. IV (type locality, mountains of northeastern Kwangtung, 500–800 meters altitude).

*Gekko subpalmatus* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 478 (Yenping, Fukien; Wanhsien, Szechwan); Pope, 1929, LVIII, p. 367 (Yenping and Chungan Hsien, Fukien).

*Type locality*:—Chekiang.

*Distribution*:—Between Linping and Chungsun in Kwangtung; Kuatun and Yenping in Fukien; Chekiang (no specific locality); Wanhsien, Chungking, Hochuan, Kunghsien (southwest of Sūchow), Sūchow, Fulin, Chengtu and near Yachow in Szechwan.

*Material examined*:—The type and a specimen from Kuatun in the British Museum. Two topotypes of *G. melli* in the Berlin Museum collected by Mell. Kunghsien, 1 specimen; Sūchow, 12 specimens; Fulin, 1 specimen; near Yachow, 1 specimen (U. S. National Museum). Yenping, 14 specimens; Chungan Hsien, 2 specimens; Wanhsien, 1 specimen (American Museum).

*Remarks*:—Dr. Mell has informed me in person that the actual type locality of *Gekko melli* is his "Lackpasswald" situated in the mountains of northeastern Kwangtung between Linping and Chungsun.

In 1929 (pp. 367 and 368), I erroneously described the toes of Yenping and Chungan Hsien *subpalmatus* as "fully webbed" when, of course, I intended to use the phrase "distinctly webbed."

15. **Gekko swinhonis** Guenther

*Gekko swinhonis* Guenther, 1864, Rept. Brit. India, p. 104, Pl. XII.

*Gekko swinhonis* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 478 (Hsinglungshan, Hopei; Sohuang and Chintzu, Shansi); Pope, 1929, LVIII, p. 368 (Western Hills, Hopei; Tsinan [region], Shantung).

*Type locality*:—Peiping (Boulenger, 1885, p. 189). Guenther merely gave "Northern China."

*Distribution*:—*G. swinhonis* is widely distributed in northeastern China and probably ranges westward into Kansu. Compare the remarks made above under the corresponding heading of *japonicus*.

*Material examined*:—Hsinglungshan, 33 specimens; Kolan, 1 specimen (No. 31121); Sohuang, 2 specimens; Chintzu, large series; Western Hills, large series; Tsinan region, large series (American Museum).

*Remarks*:—There can be no doubt that both *japonicus* and *swinhonis* have been artificially transported in China, especially up and down the coastal region, along the Grand Canal, and inland up the larger rivers. Nevertheless, the former is still predominantly of central, the latter of northern distribution in China.

Genus **Eublepharis**

Gray, 1827, Philosoph. Mag., (2) II., p. 56.

Genotype, by monotypy, *E. hardwickii* Gray

16. **Eublepharis lichtenfelderi** Mocquard

*Eublepharis lichtenfelderi* Mocquard, 1897, Bull. Mus. Hist. Nat., Paris, III, p. 213.

*Goniurosaurus hainanensis* Barbour, 1908, Bull. Mus. Comp. Zool., LI, p. 316 (type locality, Wuchih Mts., Hainan).

*Type locality*:—Norway Islands, Tongking.

*Distribution*:—Known only from the type locality and Hainan.

*Material examined*:—I have seen the 2 cotypes of *E. lichtenfelderi* in the Paris Museum, as well as the type of *G. hainanensis* in the Museum of Comparative Zoölogy.

Family AGAMIDÆ

KEY FOR IDENTIFICATION OF CHINESE GENERA

I. No femoral pores

A. A wing-like lateral expansion supported by prolongations of ribs

*Draco*

B. No wing-like lateral expansion supported by prolongations of ribs

1. Body not depressed

a. Tympanum hidden (except in *Japalura dymondi* which has heterogeneous dorsal scales and no postorbital spine)

(1) Tubercles intermixed with dorsal scales. . . . .

*Phoxophrys*

(2) No tubercles intermixed with dorsal scales. . . . .

*Japalura*

b. Tympanum exposed

- (1) Dorsal scales not uniform in size, heterogeneous; postorbital spine present. . . . . *Gonocephalus*
- (2) Dorsal scales uniform in size or, if not uniform in size, lateral body scales pointing backward and downward (*fruhstorferi*) or anterior throat scales smooth (*kakhienensis*). . . . . *Calotes*
- 2. Body depressed; tympanum hidden or absent; no nuchal or dorsal crest. . . . . *Phrynocephalus*

II. Femoral pores present

- A. Tail strongly compressed, more or less crested above. . . . . *Physignathus*
- B. Body depressed, tail rounded; no dorsal or caudal crest. . . . . *Leiolepis*

Genus *Draco*

Linnaeus, 1758, Syst. Nat., Ed. 10, p. 199.

Genotype, by monotypy, *D. volans* Linnaeus

17. *Draco maculatus* (Gray)

*Dracunculus maculatus* Gray, 1845, Cat. Liz. Brit. Mus., p. 236.

*Draco maculatus* Cantor, 1847, Journ. Asiat. Soc. Bengal, XVI, p. 645.

*Draco whiteheadi* Boulenger, 1899, Proc. Zool. Soc. London, p. 956, Pl. LXVI (type locality, Wuchih Mts., Hainan).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 413 (Nodoa region, Hainan).

*Type locality*:—Penang.

*Distribution*:—China: Hainan; Pangsi in extreme western Yunnan.

Widely distributed in southeastern Asia from Assam and southern China south-eastward to and including at least part of the Malay Peninsula. Smith (1930, p. 21) questions its presence on Penang, the type locality.

*Material examined*:—Type of *D. whiteheadi* (British Museum). Nodoa region, large series (American Museum).

Genus *Phoxophrys*

Hubrecht, 1881, Notes Leyden Mus., III, p. 51.

Genotype, by monotypy, *P. tuberculata* Hubrecht

18. *Phoxophrys grahami* Stejneger

*Phoxophrys grahami* Stejneger, 1924, Occ. Papers Boston Soc. Nat. Hist., V, p. 120.

*Type locality*:—Süchow, Szechwan.

*Distribution*:—Known only from the type locality.

*Material examined*:—I have seen the only known specimen, the type preserved in the U. S. National Museum.

Genus *Gonocephalus*

Kaup, 1826, Isis, 1825, p. 590.

Genotype, by monotypy, *Agama tigrina* Kaup = *G. chamaeleontinus* (Laurenti)

19. *Gonocephalus lepidogaster* (Cuvier)

*Calotes lepidogaster* Cuvier, 1829, Règ. Anim., Ed. 2, II, p. 39.

*Acanthosaura lamnidentata* Boulenger, 1885, Cat. Liz. Brit. Mus., I, p. 302, Pl. XXII (type localities, Pegu and Tenasserim).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 480 (near Yenping, Fukien).—Pope, 1929, LVIII, p. 370 (Yenping and Chungan Hsien, Fukien).

*Acanthosaura hainanensis* Boulenger, 1899, Proc. Zool. Soc. London, p. 957, Pl. LXVI (type locality, Wuchih Mts., Hainan).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 414 (mountains south of Nodda, Hainan).

*Acanthosaura braueri* Vogt, 1915, Sitzber. Ges. Naturf. Freunde Berlin, p. 97 (Mell, collector).—Mell, 1922, Archiv. Naturg., LXXXVIII, Abt. A, Heft 10, p. 112 (type locality, bamboo forest region east of Shiuchow, Kwangtung).

*Gonocephalus lepidogaster* Smith, 1935, Fauna Brit. India, Rept. Amphib., II, p. 161.

*Type locality*:—Cochin-China.

*Distribution*:—China: Yaoshan in Kwangsi; Kwangtung, including Hainan; Yenping and Chungan Hsien in Fukien.

Widely distributed in French Indo-China; also known from Siam and Burma.

*Material examined*:—Manson Mts., 3 specimens; Thai-Nien, 2 specimens; Ngoi-Tio, 2 specimens; type of *A. hainanensis*; the 2 cotypes of *A. lamnidentata* (British Museum). Lohsiang, 2 specimens (Museum of Comparative Zoölogy). Kuchen, 2 specimens (U. S. National Museum). Yenping and vicinity, 21 specimens; Chungan Hsien, 36 specimens; mountains south of Nodda, 15 specimens (American Museum).

Genus *Japalura*

Gray, 1853, Ann. Mag. Nat. Hist., (2) XII, p. 387.

Genotype, by monotypy, *J. variegata* Gray

## KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Tympanum naked. . . . . *dymondi*
- II. Tympanum hidden
  - A. Enlarged dorsal scales not in regular longitudinal rows; an isolated dark stripe from eye to angle of mouth. . . . . *yunnanensis*
  - B. A row of enlarged scales on each side of median dorsal row
    - 1. The leg extended forward fails to reach eye or reaches its posterior corner. . . . . *flaviceps*
    - 2. The leg extended forward reaches to or just beyond anterior corner of eye. . . . . *splendida*

20. *Japalura dymondi* (Boulenger)

*Acanthosaura Dymondi* Boulenger, 1906, Ann. Mag. Nat. Hist., (7) XVII, p. 567.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 479 (Wuting Hsien, Yunnan).

*Acanthosaura varcoæ* Boulenger, 1918, Ann. Mag. Nat. Hist., (9) II, p. 162 (type localities, Yunnanfu and Wutingchow, Yunnan).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 480 (Snow Mountain, Yunnan, and "topotypes").

*Japalura dymondi* Smith, 1935, Fauna Brit. India, Rept. Amphib., II, p. 172.

*Type locality*:—Tungchwan, Yunnan.

*Distribution*:—Snow Mountain, Likiang, Talu (26° 37' x 100° 50'), Wuting Hsien, between Yunnanfu and Tali, Yunnanfu and Tungchwan in Yunnan.



*Material examined*:—The 4 cotypes of *dymondi* and the 2 cotypes of *varcoæ* (British Museum). Snow Mt., 1 specimen; Wuting Hsien, 2 specimens; Yunnanfu, 2 specimens (American Museum).

21. ***Japalura flaviceps*** Barbour and Dunn

*Japalura flaviceps* Barbour and Dunn, 1919, Proc. New England Zool. Club., VII, p. 16.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 480 (Likiang and Snow Mountain, Yunnan).

*Type locality*:—Tung River in Szechwan or Hsikang.

*Distribution*:—Likiang and Snow Mountain in Yunnan; Yakalo ( $29^{\circ} \times 98^{\circ} 34'$ ), Batang, Luting and the region of Tatsienlu in Hsikang; Tung River in Szechwan or Hsikang; Wenchwan, Mowhsien (Mowchow) ( $31^{\circ} 39' \times 103^{\circ} 45'$ ), and Lungan in Szechwan.

*Material examined*:—The type and 4 paratypes from the type locality (Museum of Comparative Zoölogy). Likiang, 1 specimen listed as *J. yunnanensis* by Werner (1924, p. 41) (Senckenbergisches Museum, Frankfort). Yunnan, 8 specimens; Yakalo, 1 specimen; Batang, 3 specimens; Luting, 5 specimens; Mowhsien, 3 specimens (Berlin Museum). Two paratypes, 1 from Likiang, the other from the Snow Mountain (American Museum).

22. ***Japalura splendida*** Barbour and Dunn

*Japalura splendida* Barbour and Dunn, 1919, Proc. New England Zool. Club., VII, p. 18.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 481, Pl. xxix (Yenchingkou, Szechwan).

*Type locality*:—Nantu, Hupeh. Nantu is on the Yangtze River just above Ichang.

*Distribution*:—Tahopa ( $33^{\circ} 18' \times 108^{\circ} 7'$ ) in Shensi; Szechwan; Ichang and Nantu in Hupeh.

*Material examined*:—The type and 2 paratypes; Szechwan, near Yunnan border south of Süchow, 9 specimens; near Fulin, 5 specimens; near Washan, 6 specimens; between Lungchih and Chinkouho, 2 specimens; Mt. Omei, 7 specimens (U. S. National Museum). Yenchingkou, 12 specimens (American Museum).

*Remarks*:—This handsome species is widely distributed in Szechwan.

23. ***Japalura yunnanensis*** Anderson

*Japalura yunnanensis* Anderson, 1879, Zool. Res. W. Yunnan, p. 803, Pl. LXXVI.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 482 (Tengyueh and Homushu pass, Yunnan).—Smith, 1935, Fauna Brit. India, Rept. Amphib., II, p. 175.

*Type locality*:—Tengyueh, Yunnan.

*Distribution*:—Tengyueh, Taipingpu (about  $25^{\circ} \times 98^{\circ} 45'$ ), Homushu pass (about  $25^{\circ} \times 98^{\circ} 46'$ ) and Lungling in Yunnan.

*Material examined*:—Tengyueh, 4 specimens; Homushu pass, 1 specimen (American Museum). Taipingpu, 1 specimen; Lungling, 1 specimen (Mus. Comp. Zool., Nos. 12462 and 12463, respectively).

*Remarks*:—The synonymy given above includes all the valid references to *yunnanensis* in the literature. The numerous additional ones are based for the most part on specimens of *J. flaviceps* and *splendida*.

Genus **Calotes**

Cuvier, 1817, Règ. Anim., II, p. 35.

Genotype, by monotypy, *Lacerta calotes* Linnæus

## KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Scales on sides of body pointing backward and downward . . . . . *fruhstorferi*
- II. Scales on sides of body pointing backward and upward
- A. An oblique fold or triangular pit covered with small granular scales in front of shoulder
1. Dorsal scales not uniform in size . . . . . *kakhiensis*
2. Dorsal scales uniform in size
- a. Color brown; postorbital spine present . . . . . *emma*
- b. Color green; no postorbital spine . . . . . *jerdoni*
- B. No oblique fold or triangular pit in front of shoulder . . . . . *versicolor*

24. *Calotes emma* Gray

*Calotes Emma* Gray, 1845, Cat. Liz. Brit. Mus., p. 244.

*Calotes alticristatus* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 482, fig. 3 (type locality, Yunnanfu).

*Type locality*:—"Afghanistan."

*Distribution*:—China: Kwangtung (no specific locality); Yunnanfu.

Distributed from Goalpara and the Garo Hills, Assam, eastward to Kwangtung and southward into the Malay Peninsula. Also known from the Kachin Hills east of Bhamo and Tongking.

*Material examined*:—I have seen the type of *C. alticristatus* (American Museum).

25. *Calotes fruhstorferi* (Werner)

*Acanthosaura fruhstorferi* Werner, 1904, Zool. Anz., XXVII, p. 461.

*Acanthosaura brevipes* Werner, 1904, Zool. Anz., XXVII, p. 462 (type locality, Tongking).

*Acanthosaura quinquicarinata* Fan, 1931, Bull. Dept. Biol. Col. Sci. Sun Yatsen Univ., No. 11, p. 28 (type locality, Lohsiang, Kwangsi).

*Calotes fruhstorferi* Smith, 1935, Fauna Brit. India, Rept. Amphib., II, p. 188.

*Type locality*:—Tongking.

*Distribution*:—This species is known only from Lohsiang in Kwangsi and Tongking.

*Material examined*:—Two cotypes in the British Museum.

*Remarks*:—Great confusion exists over the two cotypes of *Acanthosaura brevipes* Werner.

I have seen two specimens in the Senckenbergisches Museum, Frankfurt, labeled "cotypes." Dr. Smith writes me (July, 1934) from London that he has seen two other specimens, one in the Paris Museum and the other in the Naturhistorisches Museum, Vienna, which he presumes to be the true cotypes. In addition, a "para-type" is preserved in the Museum of Comparative Zoölogy. It was received from the Senckenbergisches Museum.

26. *Calotes jerdoni* Guenther

*Calotes jerdoni* Guenther, 1870, Proc. Zool. Soc. London, p. 779, Col. Pl. XLV.

*Calotes maria* Anderson, 1879, Zool. Res. W. Yunnan, p. 806 (not of Gray, 1845) (Tengyueh district, Yunnan).

*Calotes yunnanensis* Annandale, 1905, Journ. Proc. Asiat. Soc. Bengal, (N.S.) I, p. 87 (type locality, Tengyueh, Yunnan).

*Type locality*:—Khasya.

*Distribution*:—Known in China only from the Tengyueh district, Yunnan.

Distributed from Assam and the Chin Hills eastward to extreme western Yunnan.

*Remarks*:—Annandale based his *Calotes yunnanensis* on the single remaining specimen of the series of Tengyueh district lizards determined by Anderson in 1879 (p. 806) as *C. maria*. Dr. Smith identifies (in correspondence) this specimen as *C. jerdoni*.

27. *Calotes kakhienensis* (Anderson)

*Oriocalotes kakhienensis* Anderson, 1879, Zool. Res. W. Yunnan, p. 806, Pl. LXXVI.

*Acanthosaura kakhienensis* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 479 (Tengyueh, Yunnan).

*Calotes kakhienensis* Smith, 1935, Fauna Brit. India, Rept. Amphib., II, p. 188.

*Type locality*:—Pangsi, Yunnan.

*Distribution*:—China: Pangsi and Tengyueh in Yunnan.

Also known from the mountainous regions of Burma east of the Irrawaddy.

*Material examined*:—Tengyueh, 12 specimens (American Museum).

28. *Calotes versicolor* (Daudin)

*Agama versicolor* Daudin, 1803, Hist. Nat. Rept., III, p. 395, Col. Pl. XLIV.

*Calotes versicolor* Fitzinger, 1826, Neue Class. Rept. p. 49.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 415 (Nodoa, Hainan).

*Type locality*:—Unknown.

*Distribution*:—China: Hainan northward to Hsiaokeng (east of Shiuchow) in Kwangtung; Lohsiang in Kwangsi.

Widely distributed in India and the peninsula of southeastern Asia; well known on Ceylon and recorded from Sumatra. Common at Bhamo.

*Material examined*:—Nodoa, large series (American Museum).

Genus *Phrynocephalus*

Kaup, 1826, Isis, 1825, p. 591.

Genotype, by subsequent designation, *P. caudivolvulus* Fitzinger = *P. guttatus* (Gmelin)

KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Nostrils lateral or antero-lateral; each in a vertical plane, not or scarcely visible from directly above. . . . . *vlangalii*
- II. Nostrils anterior; not in a vertical plane, distinctly visible from above
  - A. Supraoculars granular, subequal, noticeably smaller than other dorsal head scales
    - 1. Abdomen dark brown or blackish. . . . . *przewalskii*
    - 2. Abdomen not dark brown or blackish. . . . . *frontalis*
  - B. Supraoculars not granular, unequal in size, only slightly smaller than other dorsal head scales. . . . . *versicolor*

This key should suffice when comparative series are available, but in default of such, great difficulty may be encountered. The following statements should prove helpful:

- 1. Conspicuous areas of black or dark brown never occur on the abdomen in *versicolor* and *frontalis*, while such areas are normally present in adult *przewalskii* and *vlangalii*.
- 2. Although juvenile *przewalskii* and *frontalis* are sometimes indistinguishable, adults differ markedly in coloration. The former species develops blackish or dark brown coloration.

tion on the top of the head, upper surface of limbs, vertebral region and abdomen, while *frontalis* retains throughout life the spotted pattern of its infancy, never exhibiting conspicuous blackish or dark brown areas. The blackish or dark brown abdominal coloration of *przewalskii* is used in the key because it apparently develops earliest.

The species of *Phrynocephalus* from Sinkiang, Mongolia and northern China are in such a state of confusion that it is impossible to tell how many forms actually inhabit China. There can be no doubt, however, that the four species listed below constitute the main part of the Chinese *Phrynocephalus* fauna. With these as a firm basis, additional forms may be added as their existence within the limits of the area concerned is demonstrated. The literature is crowded with names most of which are obviously meaningless.

29. ***Phrynocephalus frontalis* Strauch**

- Phrynocephalus frontalis* Strauch, 1876, Przewalski's Mongholiya i strana Tanghutov, II, pt. 3, p. 15, Pl. III.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 483 (Maitaichao, Suiyuan).  
*Phrynocephalus Potanini* Bedriaga, 1907, Wiss. Res. Przewalski Cent.-Asien Reisen, Zool., III, Abt. 1, p. 144; 1909, p. 389, Pl. VI (type localities, Hwangho and Ulan muren in the Ordos Desert).  
 ?*Phrynocephalus suschkianus* Zarevskij, 1927, Comp. Rend. Acad. Sci. URSS, A, p. 304 (type locality, along Tangar River, eastern Nanshan).

*Type locality*:—Ordos Desert.

*Distribution*:—*P. frontalis* is known with certainty from Yulin in Shensi to Maitaichao and the region 30 miles southeast of Kweihwa in Suiyuan.

Numerous more or less reliable records extend its range far to the north and west, but, since *frontalis* can be so easily confused with *versicolor*, the safest procedure is to disregard these records until they have been corroborated.

*Material examined*:—Maitaichao, large series (American Museum). Yulin, 7 specimens; about 30 miles southeast of Kweihwa, 8 specimens (U. S. National Museum).

30. ***Phrynocephalus przewalskii* Strauch**

- Phrynocephalus Przewalskii* Strauch, 1876, Przewalski's Mongholiya i strana Tanghutov, II, pt. 3, p. 10, Pl. II.  
*Phrynocephalus affinis* Strauch, 1876, op. cit., p. 13, Pl. II (type localities, Alashan and Ordos deserts).  
 ?*Phrynocephalus carinatus* Zarevskij, 1927, Comp. Rend. Acad. Sci. URSS, A, p. 305 (type locality, along Tangar River, eastern Nanshan).  
 ?*Phrynocephalus elegans* Zarevskij, 1927, l.c. (type locality, eastern Alashan, between Tingyuaning and Scharuzan-Sumé, Ningsia).

*Type locality*:—Alashan Desert.

*Distribution*:—Distributed in the Alashan and Ordos regions; also probably occurs along the Tangar River, east of Kokonor. Bedriaga's (1909, p. 427) record for the northern Gobi, as well as Boulenger's (1890, p. 78) for eastern Mongolia, require confirmation.

*Material examined*:—I have seen 4 topotypes collected by Przewalski in the Alashan region, 2 in the Museum of Comparative Zoölogy (collected in 1880) and 2 in the British Museum.

31. ***Phrynocephalus versicolor* Strauch**

- Phrynocephalus versicolor* Strauch, 1876, Przewalski's Mongholiya i strana Tanghutov, II, pt. 3, p. 18, Pl. III.  
*Phrynocephalus* cf. *versicolor* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 484 (260 miles southeast of Sairusu on Sairusu-Kalgan Trail; between Pangkiang (42° 50' x 113°) and Iren Dabasu (43° 45' x 112° 44'); Tsagan Nor, Mongolia).

?*Phrynocephalus parvulus* Zarevskij, 1927, Comp. Rend. Acad. Sci. URSS, A, p. 305 (type locality, eastern Alashan, between Tingyuanying and Scharuzan-Sumé, Ningsia).

*Type locality*:—Alashan Desert.

*Distribution*:—Widely distributed in Sinkiang and central and western Mongolia, ranging to the southeast as far as the Alashan in Ningsia, and the region between Pangkiang and Iren Dabasu in Chahar.

*Material examined*:—Between Pangkiang and Iren Dabasu, 11 specimens; 260 miles southeast of Sairusu on Sairusu-Kalgan Trail, 2 specimens; Tsagan Nor, 30 specimens (American Museum).

32. *Phrynocephalus vlangalii* Strauch

*Phrynocephalus Vlangalii* Strauch, 1876, Przewalski's Mongholiya i strana Tanghutov, II, pt. 3, p. 20, Pl. III.

?*Phrynocephalus birulai* Zarevskij, 1927, Comp. Rend. Acad. Sci. URSS, A, p. 304 (type localities, southern Alashan on Kansu border and along Tangar River, eastern Nanshan).

*Type locality*:—Kokonor, Chinghai.

*Distribution*:—Widely distributed over Chinghai; also found in southern Sinkiang and western and northwestern Kansu.

*Material examined*:—Upper Hwangho, 3 specimens; Zaidam Swamp, 1 specimen; between Sining and Lanchow, 1 specimen; northern side of Humboldt Range, 1 specimen; Sachow, 1 specimen (British Museum). Upper Hwangho, 1 specimen collected by Przewalski, 1880; Kokonor, 1 topotype; Zaidam Swamp, 1 specimen collected by Przewalski, 1880 (Museum of Comparative Zoölogy). Fifty miles west of Sining, 4 specimens (U. S. National Museum).

Genus *Physignathus*

Cuvier, 1829, Règ. Anim., Ed. 2, II, p. 41.

Genotype, by monotypy, *P. cocincinus* Cuvier

33. *Physignathus cocincinus* Cuvier

*Physignathus cocincinus* Cuvier, 1829, Règ. Anim., Ed. 2, II, p. 41.

*Physignathus cocincinus caudicinctus* Barbour, 1912, Proc. Biol. Soc. Wash., XXV, p. 192 (type locality, Laokay, Tongking).

*Type locality*:—Cochin-China.

*Distribution*:—China: Namkong in Kwangtung. Barbour's Laokay record makes the discovery of this species in southeastern Yunnan certain.

Distributed from Tongking southward through Cochin-China.

*Material examined*:—Namkong, 1 specimen (Berlin Museum). Bac-Kan, 1 example (British Museum); type of *P. cocincinus caudicinctus* (Museum of Comparative Zoölogy).

Genus *Leiolepis*

Cuvier, 1829, Règ. Anim., Ed. 2, II, p. 37.

Genotype, by monotypy, *L. guttatus* Cuvier

34. *Leiolepis belliana belliana* (Gray)

*Uromastix Belliana* Gray, 1827, Zool. Journ., London, III, p. 220.

*Leiolepis Bellii* Gray, 1845, Cat. Liz. Brit. Mus., p. 263.

*Leiolepis belli* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 416 (Nodoa, Hainan).

*Type locality*:—Penang.

*Distribution*:—China: Hainan, Canton and the vicinity of Wuyung in Kwangtung.

Distributed from southern Burma southeastward through the peninsula of south-eastern Asia into Sumatra.

*Material examined*:—Nodoa, large series (American Museum).

#### Family SHINISAURIDÆ

##### Genus *Shinisaurus*

Ahl, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 329.

Genotype, by monotypy, *S. crocodilurus* Ahl

#### 35. *Shinisaurus crocodilurus* Ahl

*Shinisaurus crocodilurus* Ahl, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 329.

*Type locality*:—Yaoshan, Kwangsi.

*Distribution*:—Known only from "Lohsiang and its neighboring villages" of the Yaoshan region.

*Material examined*:—I have seen a toplotype in each of the following museums: British Museum, U. S. National Museum, Museum of Comparative Zoölogy and the American Museum.

#### Family ANGUIDÆ

##### Genus *Ophisaurus*

Daudin, 1803, Bull. Soc. Philom. Paris, III, No. 72, p. 188.

Genotype, by monotypy, *Anguis ventralis* Linnæus

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Three or four scales normally separating nasals and rostral from azygous prefrontal..... *gracilis*
- II. Two scales normally separating nasals and rostral from azygous prefrontal..... *harti*

Save for a weak, interrupted middorsal black stripe, juvenile *harti* is white above, uniform black on the sides and below. Juvenile *gracilis*, on the other hand, is uniform white save for the following black markings: (a) a scale-and-a-half-wide longitudinal stripe a scale's width above the lateral fold, beginning just posterior to the nostril and extending to the tip of the tail, (b) a longitudinal stripe as wide as half a scale running one and a half to two scale widths below the lateral fold and extending from under the eye to the end of the body, (c) a few small dorsal spots, (d) a little pigment along the edge of the lateral fold.

#### 36. *Ophisaurus gracilis* (Gray)

*Pseudopus gracilis* Gray, 1845, Cat. Liz. Brit. Mus., p. 56.

*Ophisaurus gracilis* Boulenger, 1885, Cat. Liz. Brit. Mus., II, p. 283, Pl. xv.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 486 (Yunnanfu).

*Ophisaurus harti* Taylor, 1934, Lingnan Sci. Journ., XIII, p. 302 (Mengtsz, Yunnan) (not of Boulenger, 1899).

*Type locality*:—Khasi Hills, Assam.

*Distribution*:—China: Wutingchow, Yunnanfu, Mengtsz and Muangla in Yunnan.

Distributed from northeastern India southward into Burma. Also known from Xieng Khouang, Laos.

*Material examined*:—Type; Wutingchow, 1 specimen (British Museum). Yunnanfu, 2 specimens (American Museum). Mengtsz, 1 specimen (kindness of E. H. Taylor).

*Remarks*:—Great care should be exercised in identifying material of *gracilis* and *harti* from the eastern limits of the range of the former and the western extremity of the range of the latter.

37. **Ophisaurus harti** Boulenger

*Ophisaurus harti* Boulenger, 1899, Proc. Zool. Soc. London, p. 160, fig. 1, Pl. xvi.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 486 (Shaowu, Fukien); Pope, 1929, LVIII, p. 370, Pl. xvii (Chungan Hsien, Fukien).

*Ophisaurus Ludovici* Mocquard, 1905, Bull. Mus. Hist. Nat., Paris, XI, p. 76 (type locality, Bao Lac, Tongking).

*Type locality*:—Kuatun, Fukien.

*Distribution*:—China: Mokanshan in Chekiang; Chungan Hsien (including Kuatun) and Shaowu in Fukien; Chouchiakou and Huangchiakou, Szechow and between Lungchih and Chinkouho in Szechwan.

Also known from Tongking and Formosa.

*Material examined*:—Four cotypes (British Museum). Type of *O. ludovici* (Paris Museum). Shaowu, 1 specimen; Chungan Hsien, 32 specimens (American Museum).

*Remarks*:—Further study of Tongking material is needed since it may re-establish the validity of *ludovici*, but the available data indicate that *ludovici* is not distinct from *harti*. The number of transverse rows of scales from vent to occiput or end of lateral groove in Tongking specimens should be tabulated for comparison with similar counts of Fukien *harti*. Maximum size should also be taken into consideration.

Family VARANIDÆ

Genus **Varanus**

Merrem, 1820, Versuch Syst. Amphib., p. 58.

Genotype, by subsequent designation, *Lacerta varia* Shaw

38. **Varanus salvator** (Laurenti)

*Stellio salvator* Laurenti, 1768, Syn. Rept., p. 56.

*Varanus salvator* Cantor, 1847, Journ. Asiat. Soc. Bengal, XVI, p. 635.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 418 (Namfong region, Hainan).

*Type locality*:—"America."

*Distribution*:—China: Kwangtung (including Hainan) north to Tsingyun.

Widely distributed in southeastern Asia and the East Indies.

*Material examined*:—Namfong region, 5 specimens (American Museum).

Family LACERTIDÆ

KEY FOR IDENTIFICATION OF CHINESE GENERA

I. Dorsal scales strongly keeled, not granular; five or fewer inguinal (femoral) pores

- A. Distal joint of digits not bent at an angle to preceding ones or compressed proximally. . . . .

*Takydromus*

- B. Distal joint of digits bent at an angle to preceding ones and slightly compressed proximally..... *Platyplacopus*
- II. Dorsal scales granular, not keeled; seven or more femoral (inguinal) pores..... *Eremias*

In describing the genera *Platyplacopus* and *Apeltonotus* (type, *Takydromus dorsalis* Stejneger), Boulenger (1917, pp. 231 and 233) failed to notice that the two species on which he based these genera possessed the digital character of the former genus. I have therefore united the genera on the basis of this character which, unfortunately, is not always easily recognized. Field observations on species of *Takydromus* and *Platyplacopus* should shed light on the relative importance of this character. It may have arisen independently in response to similar habitat requirements and thus not indicate close relationship of the species exhibiting it.

### Genus *Takydromus*

Daudin, 1803, Hist. Nat. Rept., III, p. 251.

Genotype, by subsequent designation, *T. quadrilineatus* Daudin = *T. sexlineatus* Daudin

#### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Four pairs of chin-shields; scales of median ventral longitudinal rows smooth..... *wolteri*
- II. Normally three pairs of chin-shields; scales of median ventral longitudinal rows distinctly keeled
- A. Eight longitudinal ventral rows of large uniformly developed scales; dorsal scales normally in six longitudinal rows..... *septrionalis*
- B. Ten to twelve longitudinal ventral rows of large uniformly developed scales; dorsal scales normally in four longitudinal rows..... *sexlineatus meridionalis*

#### 39. *Takydromus septrionalis* Guenther

*Tachydromus septrionalis* Guenther, 1864, Rept. Brit. India, p. 70, Pl. VIII.

*Takydromus septrionalis* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 487 (Yenchingkou and Wanhhsien, Szechwan; Yochow, Hunan; Ningkwo, Anhwei).—Pope, 1929, LVIII, p. 374 (Hokow, Kiangsi; Chungan Hsien, Yenping and Futsing Hsien, Fukien).

*Type locality*:—Ningpo.

*Distribution*:—China: Widely distributed in central China, its range extending in the east from Futsing Hsien in Fukien and the mountains of northern Kwangtung north-eastward to Nanking and Chinkiang; in the west, from the region of Süchow and that of Washan in Szechwan, northeastward to Hweihsien in southern Kansu and the Tsinling Mountains of Shensi. There is also a record for Yumen (40° 18' x 97° 14') in Kansu.

Also known from Formosa and the Pescadores Islands.

*Material examined*:—Yenchingkou, 5 specimens; Wanhhsien, 4 specimens; Yochow, 1 specimen; Ningkwo, large series; Hokow, 3 specimens; Chungan Hsien, large series; Yenping, 35 specimens; Futsing Hsien, 3 specimens (American Museum).

#### 40. *Takydromus sexlineatus meridionalis* Guenther

*Tachydromus meridionalis* Guenther, 1864, Rept. Brit. India, p. 70, Pl. VIII.

*Takydromus sexlineatus meridionalis* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 55.—



Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 419 (Hainan); p. 487 (Fukien).—Pope, 1929, LVIII, p. 375 (Futsing Hsien and Chungan Hsien, Fukien).

*Tachydromus kwangsiensis* Ahl, 1930, Sitzber. Ges. Naturf. Freunde Berlin, p. 327 (type locality, Yaoshan, Kwangsi).

*Type locality*:—Southern China.

*Distribution*:—China: Nanning and Yaoshan in Kwangsi; Kwangtung (including Hainan); Chungan Hsien, Yenping region and Futsing Hsien in Fukien.

*Material examined*:—Hainan, large series; Chungan Hsien, 2 specimens; Futsing Hsien, 21 specimens (American Museum). Type of *T. kwangsiensis* (Berlin Museum).

*Remarks*:—*T. sexlineatus* is widely distributed in Burma, the peninsula of southeastern Asia and the East Indies. The typical form presumably intergrades with *meridionalis* somewhere to the south or southwest of China, but the exact region of intergradation has never been clearly defined. The uniformity of *meridionalis* characters in Chinese specimens strongly contrasts with the lack of uniformity in the absence of these same characters exhibited by many specimens from the Asiatic mainland to the south and southwest of China.

41. ***Takydromus wolteri*** Fischer

*Tachydromus Wolteri* Fischer, 1885, Jahrb. Hamburg. Wiss. Anst., II, p. 82.

*Takydromus wolteri* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 486 (Fukien; Ningkwo, Anhwei; Wanhsien, Szechwan).

*Type locality*:—Chemulpo, Korea.

*Distribution*:—China: Fukien; Kiukiang region in Kiangsi; Ningkwo in Anhwei; Nanking; Wanhsien in Szechwan.

Also known from Quelpart Island, Korea, Manchuria and the Far Eastern District.

*Material examined*:—Fukien, 1 specimen; Ningkwo, large series; Wanhsien, 10 specimens (American Museum).

Genus ***Platyplacopus***

Boulenger, 1917, Mem. Asiat. Soc. Bengal, V, p. 231.

Genotype, by monotypy, *Takydromus kuehnei* Van Denburgh

KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Dorsal scales small, not disposed in regular longitudinal rows, not sharply differentiated in size and arrangement from lateral scales. . . . . *sylvaticus*
- II. Dorsal scales large, disposed in regular longitudinal rows, sharply differentiated in size and arrangement from lateral scales
  - A. Two inguinal pores on each side. . . . . *intermedius*
  - B. Three to five inguinal pores on each side. . . . . *kuehnei*

42. ***Platyplacopus intermedius*** (Stejneger)

*Takydromus intermedius* Stejneger, 1924, Occ. Papers Boston Soc. Nat. Hist., V, p. 120.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 488 (Yunnanfu).

*Type locality*:—Hsinkaiszu, Mt. Omei, Szechwan.

*Distribution*:—Yachow region, Mt. Omei, Süchow and Chouchiakou in Szechwan; Yunnanfu.

*Material examined*:—The type; Mt. Omei, 1 specimen; Süchow, 2 specimens; Chou-chiakou, 1 specimen (U. S. National Museum). Yunnanfu, 2 specimens (American Museum).

*Remarks*:—The Chekiang lizard identified by Wu (1930, p. 55) as *T. intermedius*, obviously represents some other species, the generic allocation of which is uncertain. Judging by Wu's brief description, it represents an unrecognized form of either *Takydromus* or *Platyplacopus*.

43. ***Platyplacopus kuehnei*** (Van Denburgh)

*Takydromus kuehnei* Van Denburgh, 1909, Proc. Calif. Acad. Sci., (4) III, p. 50.

*Tachydromus chinensis* Vogt, 1914, Sitzber. Ges. Naturf. Freunde Berlin, p. 98 (type locality, northern Kwangtung).

*Platyplacopus kuehnei* Boulenger, 1917, Mem. Asiat. Soc. Bengal, V, p. 232, Pl. XLVII.

*Type locality*:—Kanshirei, Formosa.

*Distribution*:—China: northern Kwangtung; Yaoshan in Kwangsi. Formosa.

*Material examined*:—Type of *T. chinensis*; northern Kwangtung, 19 specimens; Yaoshan, 1 specimen (Berlin Museum).

44. ***Platyplacopus sylvaticus*** (Pope)

*Apeltonotus sylvaticus* Pope, 1928, Amer. Mus. Novitates, No. 320; 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 372 (amplified description).

*Type locality*:—Chungan Hsien, Fukien.

*Distribution*:—Known only from the type locality.

*Material examined*:—Chungan Hsien, type and 4 paratypes (American Museum).

Genus **Eremias**

Wiegmann, 1834, Herp. Mex., p. 9.

Genotype, by subsequent designation, *Lacerta velox* Pallas

KEY FOR IDENTIFICATION OF CHINESE SPECIES

I. Frontonasal single; first of the two large supraoculars usually longer than its distance from posterior loreal

A. The two series of femoral pores meeting midventrally or only narrowly separated there

1. Eighteen to 22 scales in a transverse row across middle of belly; dorsal edge of second upper labial extending anteriorly to or beyond vertical of anterior border of nostril. . . . . *vermiculata*
2. Twelve to 17 scales in a transverse row across middle of belly; dorsal edge of second upper labial not extending to vertical of anterior border of nostril. . . . . *velox roborowskii*

B. The two series of femoral pores broadly separated midventrally

1. Normally 30 (rarely as few as 27) or more gular scales in a median series between chin-shields and collar; subocular rarely entering labial margin
  - a. Four prefrontals, the outer narrow. . . . . *quadrifrons*
  - b. Two prefrontals. . . . . *przewalskii*

2. Normally 29 (rarely as many as 32) or fewer gular scales in a median series between chin-shields and collar; subocular usually entering labial margin. . . . .

*multicellata*

II. Frontonasal divided; first of the two large supraoculars usually shorter than its distance from posterior loreal

- A. Subocular entering labial margin; normally 49 or fewer scales in a straight line across middle of back; habitus relatively slender and depressed; tail relatively long; pigment generally covering all but very narrow lower margin of anterior upper labials. . . . .

*brenchleyi*

- B. Subocular rarely entering labial margin; normally 49 or more scales in a straight line across middle of back; habitus relatively thick, not depressed, tail relatively short; pigment generally confined to dorsal two-thirds of anterior upper labials. . . . .

*argus*

45. *Eremias argus* Peters

*Eremias argus* Peters, 1869, Monatsber. Akad. Wiss. Berlin, p. 61, Pl.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 488 (Hsinglungshan, Hopei; Manchuria).—Pope, 1929, LVIII, p. 376 (Tsinan [region], Shantung; Western Hills, Hopei).

*Eremias barbouri* Schmidt, 1925, Amer. Mus. Novitates, No. 175, p. 2 (type locality, Maitaichao, Suiyuan); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 489, fig. 4 and Pl. xxx (amplified description; paratypes recorded from Sohuang, Chintzu and Mayinghai near Ningwu, three Shansi localities, as well as the type locality).

*Type locality*.—Chefoo, Shantung.

*Distribution*.—*Eremias argus* is distributed from Tsingtao and Taian in Shantung westward through Kansu (Kinyang and Lanchow) to eastern Chinghai, thence north-eastward through the Alashan and Mongolia to southern Transbaikalia. In the east, its range extends into Manchuria and Korea.

Three typical specimens from Changsha in the American Museum stand as indisputable evidence of the occurrence of *argus* south of the Yangtze in northern Hunan. However, until additional material from the region between Hunan and Shantung or Kansu has been secured, its general range need not be extended to the Yangtze.

*Material examined*.—Hsinglungshan, large series; Western Hills, 5 specimens; Tsinan region, large series; Taian, 3 specimens, presented by Dr. C. C. Liu; Maitaichao, large series, including type of *barbouri*; Sohuang, 4 specimens; Mayinghai, 7 specimens; Chintzu, large series; Changsha, 3 specimens (American Museum).

*Remarks*.—The distribution of *argus* outlined above is based only on reliable records. Certain unreliable ones that would extend its range somewhat have been purposely omitted.

46. *Eremias brenchleyi* Guenther

*Eremias Brenchleyi* Guenther, 1872, Ann. Mag. Nat. Hist., (4) X, p. 419.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 492, Pl. xxx (Sohuang and Chintzu, Shansi).

*Type locality*.—"A district of Mongolia, called 'the Land of Grass.'"

*Distribution*.—China: Tsinan region and Taishan in Shantung; the Western Hills in Hopei; Nankow Pass (40° 14' x 116° 9') and Kalgan in Chahar; Sohuang and Chintzu in Shansi; Ordos region in Suiyuan.

Also known from Mongolia. A single specimen has been reported from Transbaikalia, a record that calls for confirmation. Since *argus* has been found south of the Yangtze in

Hunan, Fischer's (1888, p. 46) "Chikiang" may reasonably be taken as an error for Chekiang (Province). Here at least is tentative evidence of the occurrence of *brenchleyi* south of the Yangtze in the east.

*Material examined*:—Taishan in Shantung, 3 specimens presented by Dr. C. C. Liu; Tsinan region, small series; Sohuang, 19 specimens; Chintzu, 1 specimen; Western Hills, 1 specimen, No. 29509 (American Museum).

*Remarks*:—The following statement summarizes the situation presented by *argus* and *brenchleyi* as I see it: Two apparently distinct forms of *Eremias*, to which the names *argus* and *brenchleyi* must be applied, are widely distributed in northern China and adjacent territory. These forms are strikingly alike in general appearance, differing, however, in several characters, most of which are highly variable and hard to determine (see key). They often occur in the same region but not actually together, *argus* frequenting stoneless fields of the open plains and plateaus, *brenchleyi* inhabiting the rougher, stony country of hills and mountains. The selection of habitat is not primarily based on altitude since *argus* occurs at considerable elevations in extreme northern China and Mongolia. Even though published data indicate that *argus* and *brenchleyi* intergrade morphologically, it is hard to conceive of subspecies living in such close proximity over so extensive an area. Therefore it seems wise to grant full specific status to each until field studies have finally determined their precise relationship.

I should like to suggest that the former and, in one sense, true habitat preferences of *argus* and *brenchleyi* may have been obscured and altered by the deforestation of northern China during historic times. Due to the far-reaching effects of deforestation, a region almost entirely denuded of its primeval growth must present fewer habitats than one still covered by its original forests. It is reasonable, therefore, to suppose that the lizards in question once frequented entirely different types of country and were not thrown into such close proximity as they are today. Here at least is an hypothesis that helps to explain a puzzling situation.

The published field notes of Jacot, together with specimens and data received directly from C. C. Liu, have greatly influenced my treatment of the problem in hand. It is to be hoped that Dr. Liu will soon continue his field observations on *argus* and *brenchleyi*.

47. ***Eremias multiocellata multiocellata* Guenther**

*Eremias multiocellata* Guenther, 1872, Ann. Mag. Nat. Hist., (4) X, p. 419.

*Type locality*:—"Desert of Gobi, on the route from Sumé to the Tola River." The exact location of "Sumé" cannot now be determined.

*Distribution*:—The range of this form probably covers most of Mongolia, much of eastern Sinkiang, all of Ningsia, Kansu as far south as 37° N. Latitude, and northern and northeastern Chinghai (including Tangar, 36° 42' x 101° 6', and Sining). *Eremias m. multiocellata* also occurs in southern Manchuria (Wettstein, 1931, p. 288).

*Material examined*:—The type; Alashan Desert, 1 specimen (British Museum). Sachow, 1 specimen; 100 miles N.N.W. to 45 miles N.W. of Ningsia, 19 specimens; near Ningsia, 3 specimens; 85 miles north of Lanchow, 2 specimens; 30 miles southwest of Chungwei (37° 33' x 105° 12'), 2 specimens (U. S. National Museum). Tungliao, southern Manchuria, 1 specimen (Naturhistorisches Museum, Vienna).

*Remarks*.—*Eremias multiocellata* has been the subject of varying opinions in regard to the number of subspecies that it embraces. Due to complete lack of material, I am unable to settle this vexatious question. The distribution outlined above is the most reasonable one to expect for the typical form. If, however, specimens from Kansu and neighboring regions actually prove to be subspecifically distinct, the name *planiceps* (Strauch, 1876, p. 39, Pl. iv) is available for them.

48. *Eremias przewalskii* (Strauch)

*Podarces (Eremias) przewalskii* Strauch, 1876, Przewalski's Mongholiya i strana Tanghutov, II, pt. 3, p. 43, Pl. vii.

*Eremias przewalskii* Boulenger, 1887, Cat. Liz. Brit. Mus., III, p. 105.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 488, Pl. xxix (260 miles southeast of Sairusu on Sairusu-Kalgan Trail; between Pangkiang and Iren Dabasu, Chahar; Tsagan Nor, Mongolia).

*Type locality*.—Alashan Desert.

*Distribution*.—The distribution of this species may best be defined by the following records which approximately mark the extreme limits of its range in the different directions: Kuche in Sinkiang; Tangar River above the town of Tangar in Kansu or Chinghai; between Pangkiang ( $42^{\circ} 50' \times 113^{\circ}$ ) and Iren Dabasu ( $43^{\circ} 45' \times 112^{\circ} 44'$ ) in Chahar.

*Material examined*.—Alashan Desert, 3 topotypes collected by Przewalski in 1880; Alashan meridional, 4 specimens also collected by Przewalski in 1880 (Museum of Comparative Zoölogy). One hundred and 138 miles N.N.W. of Ningsia, 8 specimens (U. S. National Museum). Between Pangkiang and Iren Dabasu, 2 specimens; 260 miles southeast of Sairusu on Sairusu-Kalgan Trail, 1 specimen; Tsagan Nor, 4 specimens (American Museum). Ordos Desert, 2 specimens collected by Przewalski (British Museum).

49. *Eremias quadrifrons* (Strauch)

*Podarces (Eremias) quadrifrons* Strauch, 1876, Przewalski's Mongholiya i strana Tanghutov, II, pt. 3, p. 34, Pl. iv.

*Eremias quadrifrons* Boulenger, 1887, Cat. Liz. Brit. Mus., III, p. 105.

*Type locality*.—Alashan Desert.

*Distribution*.—This species is known only from the Alashan Desert. There is also a record for Mongolia, which does not, however, necessarily extend its range beyond the limits of the type locality, since the Alashan region is often considered a part of Mongolia.

*Remarks*.—I have seen no specimen of this apparently valid but rare species. New material would be most welcome.

50. *Eremias velox roborowskii* Bedriaga

*Eremias velox roborowskii* Bedriaga, 1907, Ann. Mus. Zool. St. Pétersbourg, X, p. 181.

*Type locality*.—Here fixed as Sachow, Kansu. Bedriaga's cotypes came from Sachow and Lukchun.

*Distribution*.—Known only from Lukchun in Sinkiang, and Sachow.

*Remarks*.—I recognize this subspecies with some hesitation because I have had no opportunity to study good series of any form of *E. velox*. Acquisition of additional material alone will serve to settle the status of *roborowskii*.

51. **Eremias vermiculata** Blanford

*Eremias vermiculata* Blanford, 1875, Journ. Asiat. Soc. Bengal, XLIV, pt. 2, p. 194.

*Type locality*:—Here fixed as Yarkand (or Soche) since there can be little doubt that two of the three cotypes came from this locality (Blanford, 1878, p. 18).

*Distribution*:—China: Alashan Desert, northern Alashan, Edsin gol and 100 miles N.N.W. to 45 miles N.W. of Ningsia in Ningsia; Sachow Oasis in Kansu. Widely distributed in Sinkiang. Also recorded from Mongolia.

*Material examined*:—Hami Desert, 1 specimen, and Sachow, 1 specimen, both collected by Przewalski (British Museum). Alashan Desert, 1 specimen collected by Przewalski in 1880; 100 miles N.N.W. to 45 miles N.W. of Ningsia, 2 specimens (U. S. National Museum).

## Family SCINCIDÆ

## KEY FOR IDENTIFICATION OF CHINESE GENERA

## I. Supranasals present

- |  |                |
|--|----------------|
| A. Anterior end of pterygoid bone in contact on median line of palate, the palatal vacuity not extending as far forward as a line connecting center of eyes..... | <i>Mabuya</i>  |
| B. Anterior end of pterygoid bone separated on median line of palate, the palatal vacuity extending as far forward as a line connecting center of eyes.....      | <i>Eumeces</i> |

## II. Supranasals absent

- |   |                      |
|---|----------------------|
| A. Tympanum sunk  |                      |
| 1. Frontoparietals in contact                           |                      |
| a. Lower eyelid scaly.....                              | <i>Sphenomorphus</i> |
| b. Lower eyelid with an undivided transparent disc..... | <i>Leiopisma</i>     |
| 2. Frontoparietals not in contact.....                  | <i>Ateuchosaurus</i> |
| B. Tympanum superficial.....                            | <i>Tropidophorus</i> |

Genus **Mabuya**

Fitzinger, 1826, Neue Class. Rept., p. 23.

Genotype, by virtual tautonymy, *Lacertus mabouya* Lacépède

52. **Mabuya multifasciata multifasciata** (Kuhl)

*Scincus multifasciatus* Kuhl, 1820, Beiträg. Zool. Vergl. Anat., p. 126.

*Mabuya multifasciata* Fitzinger, 1826, Neue Class. Rept., p. 52.—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 420 (Nodoa, Hainan), p. 495 (Namting River, Yunnan, near Burmese border).—Pope, 1929, LVIII, p. 377 (Yuankiang, Yunnan).

*Type locality*:—No locality is given by Kuhl but since, as pointed out by Mertens (1930, p. 257), Kuhl's material probably came from Java, I suggest that Java be considered the type locality.

*Distribution*:—China: Namting River near the Burmese border, and Yuankiang in Yunnan; Hainan.

Widely distributed from Burma southeastward through the peninsula of south-eastern Asia and the East Indies to New Guinea.

*Material examined*.—*Nodoa*, 48 specimens; Namting River, Yunnan, near Burmese border, 2 specimens; Yuankiang, 9 specimens (American Museum). Wuchih Mts., Hainan, 1 specimen (Museum of Comparative Zoölogy).

*Remarks*.—*Mabuya longicaudata* (Hallowell), well known from Siam, Tongking, and Formosa, has been originally recorded from China no fewer than four times. One of these records (Barbour, 1909, p. 64) was based on Mus. Comp. Zool. No. 7384, another (Van Denburgh, 1912, p. 228) on Calif. Acad. Sci. No. 14944. Examination of these two specimens, both of which are from Hainan, proves that they are typical *multifasciata*. The remaining records (Boulenger, 1887, p. 189, Hainan; Vogt, 1914, p. 99, Kwangtung) cannot be so conclusively eliminated. However, since I was unable to discover in the British and Berlin Museums the actual material on which these records were based, I deem it wise to exclude *longicaudata* from the Chinese fauna.

The following comparison of the two species should suffice to settle the difficulties of determination for future workers:

1. The supranasals are usually in contact behind the rostral in *longicaudata*, but separated from each other by the frontonasal and rostral in the other species.
2. With few exceptions, the prefrontals are broadly in contact in *multifasciata*, while in *longicaudata* the frontal usually forms a narrow suture with the frontonasal.
3. Normally the dorsal scales of *multifasciata* are tricarinate, those of *longicaudata* bicarinate. The keels are almost invariably stronger in the former species.
4. The midventral caudal scales of *longicaudata* are nearly always distinctly wider than the adjacent scales at and beyond a point about one head-length (measured from tip of snout to posterior margin of parietals) behind the vent. In the other species, these midventral caudal scales are rarely wider than the adjacent ones anterior to a point two or more head-lengths posterior to the vent.
5. The dark lateral stripe of *longicaudata* is very conspicuous and normally separated from the coloration of the dorsum by a scale-wide light line. Such a line is rarely evident in *multifasciata*, and its lateral coloration, though noticeably dark, is seldom as conspicuously set off as that of *longicaudata*.

It should be noted that no single character given above is invariably diagnostic.

### Genus *Sphenomorphus*

Fitzinger, 1843, Syst. Rept., p. 23.

Genotype, by original designation, *Lygosoma melanopogon* Duméril and Bibron

### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. A patch of enlarged scales on lower posterior aspect of thigh..... *boulengeri*
- II. No patch of enlarged scales on lower posterior aspect of thigh
  - A. Snout flat above, normally with a slight depression in posterior part of rostral sometimes involving part of frontonasal; scales normally in 38-42 rows..... *maculatus*
  - B. Snout less flat above, without a depression in rostral or frontonasal; scales in 32-38 rows..... *indicus*

53. **Sphenomorphus boulengeri** Van Denburgh

*Sphenomorphus boulengeri* Van Denburgh, 1912, Adv. Diag. New Rept. Amphib. Loo Choo Is. Formosa, p. 6; 1912, Proc. Calif. Acad. Sci., (4) III, p. 232 (amplified description).—Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 378 (Yenping and Chungan Hsien, Fukien).

*Sphenomorphus leveretti* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 1 (type locality, mountains south of Nodoo, Hainan); Bull. Amer. Mus. Nat. Hist., LIV, p. 422, fig. 10 (amplified description).

*Sphenomorphus indicus* Stejneger, 1925, Proc. U. S. Nat. Mus., LXVI, Art. 25, p. 52 (part: near Yenping, Fukien).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 495 (part: Tengyueh, Yunnan).

*Type locality*:—Koshun, Formosa.

*Distribution*:—China: Chungan Hsien and Yenping region in Fukien; Lohsiang in Kwangsi; mountains south of Nodoo on Hainan.

Also known from Formosa and Botel Tobago.

*Material examined*:—Formosa and Botel Tobago, 13 specimens (Calif. Acad. Sci. Nos. 18695-99, 18701-04, 18706, 25109-111). Yenping, 14 specimens; Chungan Hsien, 13 specimens; Yunnanfu, 1 specimen; Tengyueh, 2 specimens; type and paratypes of *S. leveretti* (American Museum). Near Yenping, 2 specimens (U. S. National Museum).

*Remarks*:—Fukien specimens being generally darker than those from Formosa, the light spots and stripes in them are largely obscured.

54. **Sphenomorphus indicus** (Gray)

*Hinulia Indica* Gray, 1853, Ann. Mag. Nat. Hist., (2) XII, p. 388.

*Lygosoma formosensis* Thompson, June 28, 1912, Herp. Not., No. 2 (type locality, Kanshirei, Formosa).

*Sphenomorphus indicus formosensis* Van Denburgh, July 29, 1912, Adv. Diag. New Rept. Amphib. Loo Choo Is. Formosa, p. 6.

*Lygosoma (Hinulia) indicum taeniatum* Werner, 1922, Anz. Akad. Wiss. Wien, LIX, p. 220 (type locality, Yunshan, Hunan).

*Lygosoma (Hinulia) multilineatum* Werner, 1922, Anz. Akad. Wiss. Wien, LIX, p. 221 (type locality, "Tjionra" on the Salween River at 27° 28' N. Lat., Yunnan).

*Sphenomorphus indicus* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 495 (part: Yenchingkou, Szechwan; Changsha, Hunan; near Yenping, Fukien).—Pope, 1929, LVIII, p. 380 (Futsing [Hsien] and Yenping, Fukien).

*Sphenomorphus formosensis* Pope, 1929, Bull. Amer. Mus. Nat. Hist., LVIII, p. 379 (Chungan Hsien, Fukien).

*Type locality*:—Sikkim Himalaya.

*Distribution*:—China: All of southern and much of central China, occurring as far north as Nanking in the east; Shihchuan (Shensi) and Lungan and Sungpan (Szechwan) in the west.

Distributed from the Eastern Himalayas to Annam and the Malay Peninsula.

*Material examined*:—Yenchingkou, 1 specimen; Changsha, 1 specimen; Chungan Hsien, 69 specimens; Yenping region, 23 specimens; Futsing Hsien, 5 specimens (American Museum).

*Remarks*:—Doubtless careful study of sufficient material will result in the definition of valid subspecies of *indicus* in China. In fact, *formosensis* is already fairly well defined. However, until better series are available, I prefer to use only the binomial, *Sphenomorphus indicus*, because of my inability to correlate differences with logical geographical ranges. I am inclined to think that color pattern will prove to be a better basis for separation of forms than scale counts.



55. **Sphenomorphus maculatus** (Blyth)

*Lissonota maculata* Blyth, 1853, Journ. Asiat. Soc. Bengal, XXII, p. 653.

*Type locality*:—Assam.

*Distribution*:—China: Bhamo-Tengyueh road east of but near the Burmese border of Yunnan.

Distributed from the Eastern Himalayas southward through Burma and Siam into the Malay Peninsula.

*Material examined*:—Bhamo-Tengyueh road east of but near the Burmese border of Yunnan, 1 specimen (British Museum).

Genus **Leiolopisma**

Duméril and Bibron, 1839, Erp. Gén., V, p. 742.

Genotype, by monotypy, *Scincus telfairii* Desjardin

The best treatment of this genus in China is that of Schmidt (1927, pp. 423-426 and 496-502). It is based largely on the material in the American Museum.

56. **Leiolopisma reevesii** (Gray)

*Tiliqua Reevesii* Gray, 1838, Ann. Nat. Hist., II, p. 292.

*Leiolopisma reevesii* Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 423 (Nodoa, Hainan).

*Type locality*:—China.

*Distribution*:—Widely distributed over central and southern China, *L. reevesii* has been taken as far north as the region of Hsinglungshan in northern Hopei, and that of Sining in Chinghai. It has also been collected in Hsikang.

*Remarks*:—With little doubt the acquisition of sufficient additional material will allow *reevesii* to be divided into several good forms. This was demonstrated by Schmidt who (1927, pp. 423-426 and 497) was able to separate specimens of a large Hainan series from those of a series from Szechwan. Difficulty arises when single individuals from various localities are in question for these show such a diversity of form, color and lepidosis that a study of them is bewildering. At present it is not certain whether the Chinese forms belong to a single species (*reevesii*) or to more than one species. I am, however, inclined toward the view that they belong to the same species. In any case, many names are available. The problem at hand can be finally solved only after data based on many large series from numerous widely separated localities are available.

Genus **Ateuchosaurus**

Gray, 1845, Cat. Liz. Brit. Mus., p. 107.

Genotype, by monotypy, *A. chinensis* Gray

57. **Ateuchosaurus chinensis** Gray

*Ateuchosaurus Chinensis* Gray, 1845, Cat. Liz. Brit. Mus., p. 107.

*Lygosaurus sowerbyi* Stejneger, 1924, Occ. Papers Boston Soc. Nat. Hist., V, p. 120 (type locality, Futsing Hsien, Fukien).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 496 (Fukien).—Pope, 1929, LVIII, p. 382 (Futsing Hsien).

*Lygosaurus salsburyi* Schmidt, 1925, Amer. Mus. Novitates, No. 157, p. 2 (type locality, Nodoa, Hainan); 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 426, fig. 11 (amplified description).

*Mabuia albomaculata* Vogt, 1927, Zool. Anz., LXIX, p. 282 (type locality, southern China).

*Type locality*.—China.

*Distribution*.—China: Hainan, Tinghushan and Chayuanshan in Kwangtung; Futsing Hsien in Fukien.

Also known from Hongkong and Tongking.

*Material examined*.—I have seen the three types of the first three species listed in the synonymy as well as one of the cotypes of Vogt's *M. albomaculata*. In addition, I have examined 3 specimens from northern Kwangtung (Berlin Museum), 1 from Hongkong, 2 from the Manson Mts. (British Museum), and 2 from Tongking (Senckenbergisches Museum, Frankfurt).

*Remarks*.—The relatively full data given above are especially designed to clear up the great confusion that this easily recognized and very characteristic species has caused. It should be added, however, that Vogt's (1924, p. 338) *Lygosoma chinense* is based on a mistaken identification and cannot be taken as a record of *Ateuchosaurus chinensis*. The erroneous spelling used by Vogt is apparently copied from Boulenger (1887, p. 318).

### Genus *Tropidophorus*

Duméril and Bibron, 1839, Erp. Gén., V, p. 554.

Genotype, by monotypy, *T. cocincinensis* Duméril and Bibron

### KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. Head scales smooth. . . . . *berdmorei*
- II. Head scales rugose
  - A. Frontonasal entire. . . . . *hainanus*
  - B. Frontonasal divided. . . . . *sinicus*

#### 58. *Tropidophorus berdmorei* (Blyth)

*Aspris Berdmorei* Blyth, 1853, Journ. Asiat. Soc. Bengal, XXII, p. 651.

*Tropidophorus Berdmorei* Theobald, 1868, Journ. Linn. Soc., Zool., London, X, p. 24.

*Tropidophorus yunnanensis* Boulenger, 1887, Cat. Liz. Brit. Mus., III, p. 362 (type locality, Husa valley, Yunnan).

*Type locality*.—Mergui, Burma.

*Distribution*.—China: Husa valley in western Yunnan.

Distributed in Burma and Siam.

#### 59. *Tropidophorus hainanus* Smith

*Tropidophorus hainanus* Smith, 1923, Proc. Zool. Soc. London, p. 779.

*Type locality*.—Angmao, Hainan.

*Distribution*.—China: The type locality and the foot of the Wuchih Mountains twenty miles from the type locality.

Also known from Tam Dao, Tongking.

*Material examined*.—I have seen the type and a paratype from the type locality in the British Museum, and 2 paratypes from the type locality in the Museum of Comparative Zoölogy.

#### 60. *Tropidophorus sinicus* Boettger

*Tropidophorus Sinicus* Boettger, 1886, Zool. Anz., IX, p. 519.

*Type locality*.—Tinghushan, Kwangtung.

*Distribution*.—China: Tinghushan, Lofaoshan and between Linping and Chungsun in Kwangtung; Yaoshan in Kwangsi.

Also known from the Manson Mountains of Tongking, and Hongkong.

*Material examined*.—The type (Senckenbergisches Museum, Frankfurt). Kwangtung, 1 specimen; Yaoshan, 1 specimen (Berlin Museum). Manson Mts., 1 specimen (British Museum).

Genus **Eumeces**

Wiegmann, 1834, *Herp. Mex.*, p. 36.

Genotype, by subsequent designation, *Scincus pavementatus* Geoffroy = *E. schneiderii* (Daudin)

KEY FOR IDENTIFICATION OF CHINESE SPECIES

- I. A single unpaired postmental; a strongly keeled scale immediately behind either extremity of vent; postnasals absent. . . . . *elegans*
- II. Normally two unpaired postmentals; no strongly keeled scale immediately behind either extremity of vent
  - A. Postnasal present
    - 1. A patch of enlarged scales on lower posterior aspect of thigh; pattern of back (when evident) includes three light stripes, one of which is middorsal
      - a. Prefrontals in contact; one pair of enlarged postparietals *tunganus*
      - b. Prefrontals not in contact; two pairs of enlarged postparietals. . . . . *xanthi*
    - 2. No patch of enlarged scales on lower posterior aspect of thigh; pattern of back (when evident) includes two light stripes, neither of which is middorsal; scale rows 20 or 22. . . . . *quadrilineatus*
  - B. Postnasals normally absent; no patch of enlarged scales on lower posterior aspect of thigh; scale rows usually 24, occasionally 26. . . *chinensis*

61. **Eumeces chinensis chinensis** (Gray)

*Tiliqua chinensis* Gray, 1838, *Ann. Nat. Hist.*, II, p. 289.

*Eumeces sinensis* Bocourt, 1879, *Miss. Sci. Mex.*, Rept., p. 423, Pl. xxii B.

*Eumeces chinensis* Schmidt, 1927, *Bull. Amer. Mus. Nat. Hist.*, LIV, p. 503 (Futsing [Hsien] and Yenping, Fukien; Yenchingkou, Szechwan); Pope, 1929, LVIII, p. 384, fig. 2a (Futsing Hsien, Yenping and Chungan Hsien, Fukien; Hokow, Kiangsi).

*Type locality*.—China.

*Distribution*.—China: Yenchingkou in Szechwan; Huping College near Yochow in Hunan; Nanning and Yaoshan in Kwangsi; Kwangtung including northern Hainan; Hokow in Kiangsi; Fukien; southern Chekiang. Apparently central Chekiang is the region of intergradation between typical *chinensis* and *chinensis pulcher*.

*E. chinensis chinensis* is also known from Hongkong. Vogt's (1924, p. 338) record for the upper Min River valley, Szechwan, requires confirmation.

*Material examined*.—Futsing Hsien, 38 specimens; Yenping, large series; Chungan Hsien, 6 specimens; Hokow, 13 specimens; Huping College, 1 specimen (American Museum).

*Remarks*:—The status of Formosan *chinensis* is doubtful. Examination of the three paratypes of *Eumeces chinensis formosensis* Van Denburgh leads me to believe that it is intermediate between typical *chinensis* and *pulcher* and probably does not warrant even subspecific recognition.

62. *Eumeces chinensis pulcher* (Duméril and Bibron)

*Plestiodon pulchrum* Duméril and Bibron, 1839, *Erp. Gén.*, V, p. 710.

*Eumeces pulcher* Schmidt, 1927, *Bull. Amer. Mus. Nat. Hist.*, LIV, p. 503 (part: Ningkwo, Anhwei).

*Type locality*:—China.

*Distribution*:—Ningkwo in Anhwei; Kiangsu south of the Yangtze; northern Chekiang.

*Material examined*:—Woosung, 1 specimen; Shanghai, 1 specimen; Kunshan, 1 specimen; Soochow, 1 specimen; Kanpu, 1 specimen (U. S. National Museum). Ningkwo, 6 specimens (U. S. National Museum). Shanghai, 1 specimen; Huchow, 1 specimen (California Academy of Sciences).

*Remarks*:—The present subspecies is beyond doubt a melanistic form of typical *chinensis*. None of the large series of Fukien adults examined exhibits the black dorsal lines of *pulcher*. It will be impossible to ascertain the exact difference between the forms concerned until a good ontogenetic series of the melanistic one becomes available.

63. *Eumeces elegans* Boulenger

*Eumeces elegans* Boulenger, 1887, *Cat. Liz. Brit. Mus.*, III, p. 371.—Schmidt, 1927, *Bull. Amer. Mus. Nat. Hist.*, LIV, p. 505 (Yunnanfu; Wanhhsien, Szechwan; Changsha, Hunan; Ningkwo, Anhwei; near Yenping, Fukien); Pope, 1929, LVIII, p. 386, fig. 2 (Yenping and Chungan Hsien, Fukien).

*Type locality*:—Ningpo.

*Distribution*:—China: South of the Yangtze River in Kiangsu; Ningkwo in Anhwei; Chekiang; Fukien; Tinghushan and northern Kwangtung localities in Kwangtung; Lushan in Kiangsi; Ichang in Hupeh; Changsha in Hunan; Wanhhsien, Chungking, Süchow region and Kiating in Szechwan; Yunnanfu in Yunnan. Also known from Formosa and the Riu Kiu Islands.

*Material examined*:—Yunnanfu, 1 specimen; Yunnan, 2 specimens; Wanhhsien, 1 specimen; Changsha, 1 specimen; Ningkwo, 27 specimens; Yenping region, 32 specimens; Chungan Hsien, large series (American Museum). Yenchow, 2 specimens; Tunglu, large series; Fenshui, 1 specimen; Ichang, 1 specimen (Museum of Comparative Zoölogy). Süchow, 1 specimen; Kiating, 1 specimen (U. S. National Museum).

64. *Eumeces quadrilineatus* (Blyth)

*Plestiodon quadrilineatus* Blyth, 1853, *Journ. Asiat. Soc. Bengal*, XXII, p. 652.

*Eumeces quadrilineatus* Bocourt, 1879, *Miss. Sci. Mex., Rept.*, p. 423, Pl. XXII D.—Schmidt, 1927, *Bull. Amer. Mus. Nat. Hist.*, LIV, p. 427, fig. 12 (mountains south of Nodoa, Hainan).

*Type locality*:—Here fixed as Hongkong. The type, now missing, was probably secured there.

*Distribution*:—China: Mountains south of Nodoa (Hainan) and Tinghushan in Kwangtung.

Also known from Hongkong, Tongking, Annam, Cambodia and Siam.

*Material examined*:—Tinghushan, 3 specimens (Berlin Museum). Mountains south of Nodoa, 1 specimen (American Museum). Hongkong, type of *Eumeces quadrivirgatus* (U. S. National Museum). Hongkong, 1 specimen; Manson Mts., 1 specimen;

Siam, 2 specimens (British Museum). Tongking, 3 specimens; Phuc-Son, 1 specimen (Naturhistorisches Museum, Vienna).

65. **Eumeces tunganus** Stejneger

*Eumeces tunganus* Stejneger, 1924, Journ. Wash. Acad. Sci., XIV, p. 384.

*Type locality*:—Luting, Hsikang.

*Distribution*:—Known only from three localities: Luting region, and the valley of the Tung River (probably between Luting at  $29^{\circ} 54' \times 102^{\circ} 28'$  and Rumichangku at  $30^{\circ} 50' \times 102^{\circ} 5'$ ) in Hsikang, and Lifan ( $31^{\circ} 30' \times 103^{\circ} 20'$ ) in western Szechwan.

*Material examined*:—Luting region, 13 specimens, including type and paratype (U. S. National Museum).

*Remarks*:—*E. tunganus* apparently inhabits the eastern edge of the high plateau of Tibet and western China.

66. **Eumeces xanthi** Guenther

*Eumeces xanthi* Guenther, 1889, Ann. Mag. Nat. Hist., (6) IV, p. 220.

*Eumeces pekinensis* Stejneger, 1924, Occ. Papers Boston Soc. Nat. Hist., V, p. 120 (type locality, Hsinglungshan, Hopei).—Schmidt, 1927, Bull. Amer. Mus. Nat. Hist., LIV, p. 502 (Hsinglungshan and 13 miles north of Hsinglungshan).

*Type locality*:—Ichang, Hupeh.

*Distribution*:—Known only from the region of Hsinglungshan in Hopei and Ichang in Hupeh.

*Material examined*:—The 4 cotypes (British Museum). The type of *E. pekinensis* and 2 additional specimens collected with the type (U. S. National Museum). Hsinglungshan and 13 miles north of Hsinglungshan, 12 specimens (American Museum).

*Remarks*:—Tchang's (1931, p. 275) record for Peiping requires confirmation.



**PART V**  
**APPENDICES**

## PART V

### APPENDICES

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# APPENDIX I

## MAP AND LIST OF LOCALITIES

### INTRODUCTION

THE List of Post Offices (13th Issue, Shanghai, 1932) and Postal Map of China 1920 (Shanghai) have been used as standards in the rendition of Chinese localities, but a few departures from these standards have been unavoidable. Supplementary signs (apostrophes, diereses) designed as aids to pronunciation have been dropped from all definitely allocated Chinese localities save Sūchow and Wusūeh. The term "Hsien" when used as a separate, capitalized word refers to a district rather than a (district) city or town. Quotation marks indicate unusual spelling or some degree of uncertainty.

The altitudes have been taken from many sources and are often only approximately correct. The term "low" in the third column of the list below designates river plain and delta or coastal region localities of such slight elevation that, for the purpose at hand, they may be considered to be at sea-level.

Indian localities have been spelled as they are in the Atlas (Vol. XXVI) of The Imperial Gazetteer of India (Oxford, 1931).

### MAP

The number on the left of each place name in the following list is to be found on the map at the end of the List of Localities near a dot, circle, or other sign corresponding to the place in question.

Nearly all the Chinese localities mentioned in Part II and a few obscure ones of adjacent regions are shown on the map. Those not shown are marked with an asterisk in the list. Most of the localities mentioned elsewhere in the volume are also to be found on the map.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
1	Alashan	Ningsia	11,811	38.40 x 105.40.
2	Along Bay	Tongking		
*3	Amomioshima	Riu Kiu Is.		maximum altitude 2293.

\* Not shown on map.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
4	Amoy	Fukien	low	24.28 x 118.6; given as Szeming in List of Post Offices.
*5	Ani Sakan	Burma	3000	near Maymyo.
6	Antung	Manchuria		40.6 x 124.21.
7	Anyang Hsien	Honan	low	36.4 x 114.20; also known as Changte.
8	Anyangpa	Hsikang	12,500	between Tatsienlu and Tungngolo.
9	Bac-Kan	Tongking	low	22.8 x 105.52.
*10	"Balihandién"	Jehol		not far from Chengteh (Vogt, 1924, p. 337).
11	Bao-Ha	Tongking	250	22.9 x 104.13.
12	Batang	Hsikang	9400	30.1 x 99.3; given as Paan in List of Post Offices.
13	Bhamo	Burma	350	24.17 x 97.17.
14	Botel Tobago	Formosa		22.3 x 121.30; maximum altitude 1807; also known as Kotosho.
*15	Cai Kim	Tongking		
16	Canton	Kwangtung	low	23.12 x 113.16; given as Punyu in List of Post Offices.
17	Caobang	Tongking		22.38 x 106.15.
18	Changnao	Kwangsi		24.30 x 107.30.
19	Changning	Kiangsi		24.59 x 115.36.
20	Changsha	Hunan	low	28.10 x 113.1.
21	Chanta	Yunnan	2900	24.42 x 97.53; spelled "Sanda" by Anderson, 1879.
22	Chao	Yunnan	6775	near southeastern extremity of Erh Hai.
*23	Chao Hu	Anhwei	low	
24	Chaoyangchen	Manchuria		42.40 x 126.2.
25	Chapa	Tongking	5300	near Laokay.
26	Chayuan	Chekiang		29.31 x 119.9.
27	Chayuanshan	Kwangtung		given as "Teeberg" by Mell, 1922, p. 3.
28	Chefoo	Shantung	low	37.32 x 121.25.
29	Chengtu	Szechwan	1700	30.38 x 104.2.
*30	"Chen Lang Kuan"	?		given as "Chen Lang Kuan, Gan King" by Boulenger, 1894, p. 45.
31	Chiengmai	Siam		18.44 x 98.58.
32	Chienshan			see Yuanshan.
33	Chihfeng	Jehol	1700	42.22 x 118.34.
*34	Chihsiashan	Kiangsu		near Nanking.
*35	Chingchengshan	Szechwan		mountains near Kwanhsien.
*36	Chingshui River	Anhwei	low	flows into the Yangtze at Wuhu.
37	Chinhsiu	Kwangsi		in Yaoshan, q. v.

<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
38 Chinkiang	Kiangsu	low	32.10 x 119.26.
39 Chinkouho	Szechwan	1750	just east of Washan.
40 Chintzu	Shansi	2657	a little southwest of Taiyuan.
41 Chinwangtao	Hopei	low	39.56 x 119.37.
42 Chiufeng	Kwangtung		north of Lokchong, near the Hunan boundary; spelled "Gau fung" by Mell, 1922, p. 5.
*43 Chiuhuashan	Anhwei		southwest of Tsingyang (30.38 x 117.44); spelled Kiuhwashan in List of Post Offices.
44 Chiulung Hsien	Hsikang	10,500	29.5 x 101.40; also known as Dju-rong.
45 Chonglok	Kwangtung		24.2 x 115.40.
46 Choni	Kansu		34.39 x 103.18.
*47 Chouchiakou	Szechwan		southeast of Sūchow.
48 Chowtung	Fukien		25.25 x 117.1.
49 Chuchow	Anhwei	low	32.14 x 118.24; given as Chuhsien in List of Post Offices.
50 Chukiang	Kwangtung		also known as Pearl River.
51 Chungan Hsien	Fukien	1500	27.46 x 118.2.
52 Chungchow	Szechwan		30.19 x 108.3; given as Chunghsien in List of Post Offices.
53 Chungchungchow	Szechwan		33.20 x 103.50.
54 Chungking	Szechwan	750	29.29 x 106.35; given as Pahsien in List of Post Offices.
*55 Chungmingchieh	Anhwei	low	in Tungling Hsien (30.59 x 117.-48).
56 Chungsun	Kwangtung		24.12 x 114.48.
57 Chunshan Island	Hunan	low	in Tungting Lake.
58 Chusan Islands	Chekiang		
59 Edsin gol	Ningsia		40.30 x 99.50; about 3000 to 4000 feet altitude.
60 Erh Hai	Yunnan	6700	25.45 x 100.16.
61 Fansipan Mountains	Tongking	11,000	near Laokay and the Yunnan boundary.
62 Fenshui	Chekiang		29.55 x 119.23.
63 Foochow	Fukien	low	26.7 x 119.20.
64 Fort Hertz	Burma		27.23 x 97.24; also known as Putao and Putau.
*65 Four Sisters Islands	Chekiang		
66 Fuchow	Shensi	2912	36.6 x 109.17; given as Fuhsien in List of Post Offices.
67 Fulin	Szechwan	2150	29.21 x 102.50.

## THE REPTILES OF CHINA

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
*68	Fumun	Kwangtung		
69	Futsing Hsien	Fukien		25.44 x 119.24.
70	Fuyang	Chekiang		30.3 x 119.57.
*71	Hangaodsu	Kiangsi		mountain between Ningtu and Kingan.
72	Hangchow	Chekiang	low	30.14 x 120.8; given as Hanghsien in List of Post Offices.
73	Hankow	Hupei	low	30.32 x 114.20; also known as Siakow.
*74	Hankow	?		this locality of Zarevskij, 1915, p. 57, not located.
75	Harbin	Manchuria	482	45.45 x 126.29; given as Pinkiang in List of Post Offices.
76	Hochuan	Szechwan		30.0 x 106.16; spelled Hochwan in List of Post Offices; given as Hochow on Postal Map.
77	Hoihow	Hainan	low	given as Kiungshan in List of Post Offices; also known as Kiungchow.
78	Hokow	Kiangsi		28.15 x 117.41.
79	Hokow	Yunnan	295	at the southeastern boundary of Yunnan, near Laokay.
80	Hongkong			22.12 x 114.30; maximum altitude 1825.
81	Hoshui	Kansu	4146	36.4 x 107.58.
*82	Hot Spring	Szechwan		"Hot Spring of Chungking" (Chang, 1932, p. 37).
83	Hsiaokeng	Kwangtung		northern Kwangtung; given as "Siu haang" by Mell, 1922, p. 3.
*84	Hsiaomienhsi	Szechwan		at Hochuan (Chang, 1932, p. 54).
*85	Hsiaotsun	Yunnan		a village S.S.E. of Erh Hai.
*86	Hsienhsiangchih	Szechwan		on Mt. Omei.
87	Hsikwangshan	Hunan	1969	near Sinhwa; spelled Sikwangshan in List of Post Offices.
88	Hsiling	Hopei		39.22 x 115.20.
*89	Hsinchang	Szechwan		in Opie Hsien.
90	Hsinglungshan	Hopei		in mountains near the Jehol boundary; see last map in Andrews, 1932.
91	Hsinkai	Yunnan		24.33 x 102.38; altitude about 6500.
*92	Hsinkaiszu	Szechwan	4500	on Mt. Omei.
*93	Hualienszu	Szechwan	7000	on Mt. Omei.
*94	Huangchiakou	Szechwan		southeast of Süchow and near Chouchiakou.
*95	Huangtsun	?		Wall, 1903, p. 91.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
96	Huchow	Chekiang	low	30.54 x 120.4; given as Wuhing in List of Post Offices.
97	Hululi	Shansi	6000	63 miles southwest of Taiyuan.
*98	Hungchuangping	Szechwan		on Mt. Omei.
99	Husa	Yunnan	4500	24.30 x 97.54; spelled "Hotha" by Anderson, 1879.
*100	Huton	Burma	4500	in the Kachin Hills.
101	Hwai Ho		low	eastern central China.
*102	Hwaiyuan	?		Stanley, 1919, p. xv.
103	Hwangho			also known as Yellow River.
104	Hwangpu		low	the river on which Shanghai is situated.
105	Hwangtsaopa	Kweichow	4320	24.57 x 104.36; also known as Singyi.
106	Hweihsien	Kansu	3028	33.52 x 106.6.
107	Ichang	Hupei	300	30.40 x 111.21.
108	Imen Hsien	Yunnan	5350	24.39 x 102.11.
*109	Insein	Burma	low	just north of Rangoon.
110	Irdin Manha	Chahar	3450	43.30 x 112.15.
111	Ishigaki Island	Riu Kiu Is.		maximum altitude 1689.
112	Kachek	Hainan	low	19.17 x 110.28.
*113	Kachin Hills	Burma and Yunnan		Yunnan-Burma border region at about 24° to 25°; also spelled "Kakhyen."
114	Kaichanchi	Kansu		36.20 x 105.15.
115	Kalgan	Chahar	2808	40.48 x 114.49; also known as Changkiakow.
116	Kanchuan	Shensi	3416	36.24 x 109.17.
*117	Kankao	Formosa		
*118	Kanshirei	Formosa		altitude about 2000.
*119	Kaphao	Hainan	656	highest navigable point on Kachek River.
120	Kashing	Chekiang		30.43 x 120.40.
121	Katha	Burma		west of Bhamo; altitude about 300.
*122	"Kaukong River"	Hainan		not definitely located.
123	Kelung	Formosa	low	
*124	Khasya	Assam		former name of Khasi Hills region.
125	Kholobolchi Nor	Mongolia	4150	45.20 x 100.46.
126	Kiangyin	Kiangsu	low	31.52 x 120.19.
127	Kiating	Szechwan	1100	29.36 x 103.40; given as Loshan in List of Post Offices.
128	Kichowpeh	Hopei		40.2 x 117.24.
129	Kienning	Fukien		27.3 x 118.20; altitude about 800.
*130	"Kien-té"	Anhwei		not identified; see Wall, 1903, p. 98.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
131	Kienyang	Fukien		27.21 x 118.5.
*132	Kiirun	Formosa		
133	Kingchow	Hupei		30.18 x 112.16.
134	Kingyang	Kansu	4216	36.2 x 107.42.
135	Kiukiang	Kiangsi	low	29.42 x 116.6.
*136	"Kō Kiu Wien"	Kansu		vicinity of Lanchow.
137	Kokonor	Ching Hai	10,662	
138	Kolan	Shansi		38.51 x 111.32.
*139	Kontum	Annam		
*140	Kosempo	Formosa		altitude about 5000.
141	Koshun	Formosa	low	22.0 x 120.44.
142	Kowloon	Kwangtung	low	22.20 x 114.12.
143	Kuatun	Fukien	5000	in Chungan Hsien; see Pope, 1929, p. 410; also known as "Kaotén."
*144	Kuche	Sinkiang	3609	41.45 x 83.0; also known as Kucha, Koutchar, etc.
145	Kuchen	Kwangsi		in Yaoshan, q. v.
146	Kuliang	Fukien		a few miles northeast of Foochow.
147	Kuling	Kiangsi		29.30 x 116.4; in the Lushan.
148	Kunshan	Kiangsu	low	31.21 x 120.59.
149	Kushan	Fukien		very near Kuliang.
150	Kutkai	Burma		in North Hsenwi.
151	Kutsing	Yunnan	6450	25.29 x 103.46.
152	Kutung	Yunnan	5250	25.25 x 99.33.
153	Kwanhsien	Szechwan		30.57 x 103.31.
154	Kweichow	Hupei		30.57 x 110.44; altitude about 400.
155	Kweihwa	Suiyuan	3510	40.48 x 111.38; given as Kweisui in List of Post Offices.
156	Kweiyang	Kweichow	3527	26.18 x 106.40.
157	Lamock Island	Kwangtung		23.16 x 117.16.
158	Lanchi	Chekiang		29.10 x 119.28.
159	Lanchow	Kansu	5106	36.2 x 103.48; given as Kaolan in List of Post Offices.
*160	Laochaitze	Szechwan		at Hochuan (Chang, 1932, p. 37).
161	Laokay	Tongking	295	22.26 x 103.59.
*162	Laolinkung	Hsikang	10,300	
163	Lashio	Burma		22.52 x 97.46.
*164	Lengtung	Kwangsi		in Locheng Hsien (24.48 x 108.34).
165	Lienshan	Kwangtung		24.49 x 111.53.
166	Likiang	Yunnan	8200	26.50 x 100.14.
167	Lilong	Kwangtung	low	22.40 x 114.6.
168	Lingshihszu	Fukien		in Futsing Hsien; see Pope, 1931, p. 411.
*169	Lingyun Hsien	Kwangsi		in western Kwangsi.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
170	Linping	Kwangtung	787	24.18 x 114.34; spelled Lienping by Mell, 1922, p. 5.
171	Liuchow	Kwangsi		24.17 x 109.13.
172	Locheng	Kwangsi		24.48 x 108.34.
173	Lofaoshan	Kwangtung	4150	23.15 x 114.8.
174	Lo Ho	Shensi		
175	Lohsiang	Kwangsi		in Yaoshan, q. v.
176	Lokchong	Kwangtung		25.12 x 112.57.
177	Luanshihkou	Szechwan		near Wanh sien.
178	Luchuan	Yunnan		25.34 x 102.28; altitude about 6000.
179	Lukchun	Sinkiang		42.38 x 89.44; in Turfan Depression, lower than 656.
180	Luluping	Szechwan	4250	29.18 x 103.25.
181	Lungan	Szechwan	3094	32.24 x 104.20; given as Pingwu in List of Post Offices.
182	Lungchih	Szechwan	2700	29.25 x 103.25.
183	Lungchow	Kwangsi		22.22 x 106.54.
184	Lungchwan	Yunnan	3100	24.20 x 97.55; also known as Mongwan.
185	Lungling	Yunnan	5200	24.35 x 98.41.
186	Lungtou	Kwangtung	3839	east of Shiuchow; given as "Drachenkopf" by Mell, 1922, p. 3.
187	Luningying	Szechwan	6700	28.27 x 101.43; given as "Eul-se-Yng" by Despax, 1913, p. 179.
188	Lushan	Kiangsi	4000	mountains just south of Kiukiang.
189	Lushuiho	Szechwan	6200?	26.15 x 102.3.
190	Macao	Kwangtung	low	22.12 x 113.32.
191	Maitaichao	Suiyuan		about 13 miles east of Saratsi; also known as Meteul; about the same altitude as Saratsi.
*192	Manson Mountains	Tongking	4000	northern Tongking, near the Kwangsi boundary.
193	Maymyo	Burma		east and a little north of Mandalay.
194	Mengtsz	Yunnan	4725	23.20 x 103.28.
195	Mienning	Szechwan	6200	28.34 x 102.13.
196	Min River	Fukien		
197	Min River	Szechwan		
198	Mogok	Burma		Katha District.
199	Mokanshan	Chekian		30.26 x 119.47.
*200	Monghum	Yunnan	5100	24.42 x 98.15; also known as Lopussuchang.
201	Mongkong	Kwangsi		name of a river and also of a town on the river; the town is at 23.28 x 110.47.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
202	Moukden	Manchuria	low	41.48 x 123.25; given as Shenyang in List of Post Offices.
*203	Mount Arizan	Formosa		
204	Mount Omei	Szechwan	11,000	29.32 x 103.29.
205	Muangla	Yunnan		in the Chanta valley.
206	Muping	Szechwan		30.29 x 102.49.
207	Myitkyina	Burma	500	25.25 x 97.23.
208	Myothit	Burma	400	24.23 x 97.24.
209	Namfong	Hainan		just south of Nodoa.
*210	Namkao	Hainan		in Wuchih Mts. region; altitude between 1476 and 1969.
211	Namkham	Burma	3500	23.50 x 97.45.
212	Namkong	Kwangtung	low	about 46 miles east of Canton.
213	Namting River	Yunnan		23.40 x 99.10.
214	Nanan	Kiangsi		25.39 x 114.10.
215	Nanchang	Kiangsi	low	28.30 x 115.50.
216	Nanking	Kiangsu	low	32.5 x 118.49.
217	Nanning	Kwangsi	400	22.43 x 108.3; given as Yungning in List of Post Offices.
218	Nantien	Yunnan		24.47 x 98.21.
*219	Ngaulinchiao	Szechwan		east of Süchow; not definitely identified.
220	Ngoi-Tio	Tongking	5000	just northwest of Laokay.
221	Niangtzekwan	Shansi		at the eastern boundary of Shansi on the Taiyuan railroad.
222	Ningkwo	Anhwei	low	30.55 x 118.54.
223	Ningpo	Chekiang	low	29.51 x 121.30; given as Ninghsien in List of Post Offices.
224	Ningsia	Ningsia	3773	38.30 x 106.14.
225	Ningteh	Fukien	low	26.34 x 119.36.
226	Ningtú	Kiangsi		26.22 x 115.49.
227	Ningwu	Shansi		39.7 x 112.15.
228	Ningyuan	Szechwan	5249	27.55 x 102.18; given as Sichang in List of Post Offices.
229	Nodoa	Hainan		19.32 x 109.35.
230	Norway Islands	Tongking		20.37 x 107.10.
*231	Olga Bay	Soviet Union		eastern Asiatic coast, about 43.50.
*232	Omei Hsien	Szechwan		29.35 x 103.32.
233	Opíen Hsien	Szechwan		29.5 x 103.20.
234	Pagoda Anchorage	Fukien	low	26.0 x 119.29; given as Pagoda in List of Post Offices.
235	Pangsi	Yunnan		24.30 x 97.40; the altitude is given by Anderson, 1879, p. xiv, as a little over 3000.



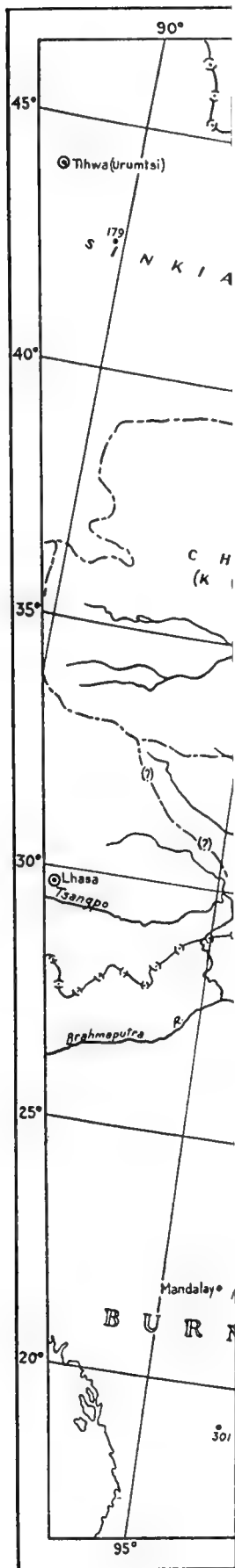
	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
236	Paotowchen	Suiyuan	3428	40.37 x 110.2; given as Paotow in List of Post Offices.
237	Patachu	Hopei		a temple in the Western Hills.
238	Peiping	Hopei	112	39.55 x 116.22; formerly known as Peking.
239	Pescadores Islands		low	just west of Formosa.
*240	Phuc-Son	Annam	low	near Tourane (Turan).
241	Pingliang	Kansu		35.21 x 106.42.
242	Pingsiang	Kiangsi		27.41 x 113.52.
243	Pratas Island			20.40 x 116.41.
244	Pupiao	Yunnan	4500	25.0 x 99.1; given as Pupiaokai in List of Post Offices.
245	Quelpart Island			off southern extremity of Korea; maximum altitude 6396.
246	Sachow	Kansu		40.10 x 94.10; given as Tunhwang in List of Post Offices.
247	Sairusu	Mongolia	3510	44.24 x 106.27.
248	Sanchiang	Fukien	3500	in Chungan Hsien; see Pope, 1931, p. 411.
249	Sanchieh	Anhwei		32.35 x 118.16.
*250	Sanfang	Kwangsi		in Locheng Hsien (24.48 x 108.34).
251	Sanshihlipu	Kansu		between Kingyang and Fucheng.
252	Santashan	Szechwan		a few miles northeast of Yenyuan.
253	Saratsi	Suiyuan	3379	40.38 x 111.10; also known as Salsien.
254	Shanghai	Kiangsu	low	31.14 x 121.29.
*254a	Shanhaikwan	Hopei		40.0 x 119.44.
255	Shaowu	Fukien		27.16 x 117.29.
256	Shaweishan	Kiangsu		31.25 x 122.13.
257	Shenchow	Hunan	455	28.26 x 110.5; given as Yuanling in List of Post Offices.
258	Shihchuan	Shensi		33.3 x 108.34.
*259	Shihwantashan	Kwangsi		in Shangsze Hsien (22.0 x 107.44).
260	Shiuchow	Kwangtung		24.54 x 113.4; given as Kukong in List of Post Offices.
261	Shiuhing	Kwangtung	low	23.5 x 112.27.
262	Shuiyuanshan	Kwangtung		east of Shiuchow; given as "Quellberg" by Mell, 1922, p. 3.
263	Sian	Shensi	1197	34.16 x 108.58; given as Changan in List of Post Offices.
264	Siangtan	Hunan		27.51 x 112.53.
*265	Sihu	Chekiang	low	near Hangchow; also known as West Lake.
266	Sinhwa	Hunan		27.32 x 111.4.
267	Sining	Chinghai	7630	36.45 x 101.38.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
*268	Sinlum Kaba	Burma	6000	in the Kachin Hills at about 25 x 97.
269	Snow Mountain	Yunnan		north of Likiang.
270	Sohuang	Shansi		near Pingting (37.54 x 113.36).
271	Soochow	Kiangsu	low	31.19 x 120.43; given as Wuhsien in List of Post Offices.
272	Spider Island	Fukien		near coast of northern Fukien.
273	Süchow	Szechwan	800	28.43 x 104.32; given as Ipin in List of Post Offices; also known as Suifu.
274	Suining	Szechwan		30.29 x 105.33.
275	Suliukuan	Kwangtung	1640	a monastery on Lofaoshan.
276	Sungpan	Szechwan	9470	32.41 x 103.21.
277	Swatow	Kwangtung	low	23.21 x 116.40.
278	Szewui	Kwangtung		23.26 x 112.31.
*279	Szuchiping	Szechwan	6000	on Mt. Omei.
280	Taian	Shantung		36.15 x 117.1.
281	Taichow	Chekiang	low	28.50 x 121.10; given as Linhai in List of Post Offices.
*282	Taihorin	Formosa		
283	Taihu	Kiangsu	low	31.5 x 120.20.
284	Taiku	Shansi		37.25 x 112.33.
285	Tainan	Formosa	low	22.59 x 120.13.
286	Taipai	Kansu	3528	east of Kingyang and near the Shensi boundary.
287	Taiyuan	Shansi	2600	37.53 x 112.29; given as Yangku in List of Post Offices.
288	Takao	Formosa	low	22.39 x 120.17.
289	Talanshan	Chekiang	2000	about 40 miles west and a little south of Ningpo; sometimes spelled "Da-laen-saen."
290	Tali	Yunnan	6700	25.40 x 100.9.
*291	Tam Dao	Tongking		northeast of Hanoi; altitude 2900-3900.
292	Tamsuy	Formosa	low	25.11 x 121.26.
293	Tangtu	Anhwei	low	just north of Taiping.
294	Taolin	Hunan	328	about 6 miles southwest of Changsha.
295	Tatsienlu	Hsikang	8400	30.3 x 102.13; given as Kangting in List of Post Offices; sometimes spelled Tachienlu.
296	Tatung	Anhwei	low	30.48 x 117.44.
297	Taunggyi	Burma		Yawng-hwe State.
*298	"Tchi-Gô"	Szechwan		in Yalung valley (Despax, 1913, p. 181); not identified.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
299	Tengyueh	Yunnan	5365	25.0 x 98.30; given as Tengchung in List of Post Offices; also known as Momien.
*300	Thai-Nien	Tongking	300	Toungoo District.
301	Thandaung	Burma		
302	Tientsin	Hopei	low	
*303	Tiger River	Kwangtung	low	Macao Island.
304	Tingan	Hainan		19.40 x 110.21.
305	Tinghushan	Kwangtung	2625	about 50 miles west of Canton; given as "Ding'wu shan" by Mell, 1922, p. 2.
306	Tsagan Nor	Mongolia	3850	45.10 x 101.26.
*307	"Tsai-Chih"	Hupei		given as near Hankow; not identified.
308	Tsangchow	Hopei	low	38.21 x 116.50; given as Tsanghsien in List of Post Offices.
*309	Tsangshan	Yunnan	14,000	mountains just west of Erh Hai.
310	Tseku	Yunnan		28.0 x 98.52.
311	Tsetsenwang	Mongolia		46.30 x 104.30.
312	Tsinan	Shantung	low	36.40 x 116.56; given as Licheng in List of Post Offices.
313	Tsinglo	Shansi		38.32 x 111.57.
314	Tsingtao	Shantung	low	36.3 x 120.18.
315	Tsingyun	Kwangtung	low	23.40 x 112.53.
316	Tsinling Mountains	Shensi	12,000	
317	Tsungfa	Kwangtung	low	23.32 x 113.33.
318	Tukhum	Suiyuan	3314	42.40 x 110.57.
319	Tungchwan	Yunnan	7250	26.23 x 103.14.
320	Tung Kiang	Kwangtung		also known as East River.
321	Tungkiayingtze	Jehol		42.36 x 117.38.
*322	Tungkweihsu	Kwangsi		in Lungchow region (Fang, 1930, p. 121).
323	Tunglan	Kwangsi		24.30 x 106.46.
*324	Tungling	Jehol		also known as Eastern Tombs; situated in the former Imperial Hunting Grounds of extreme southern Jehol.
*325	Tungling	Manchuria		imperial tombs near Moukden.
*326	Tungliu	Anhwei	low	spelled "Tong-lieou" by Heude, 1880, p. 35; not certainly identified.
327	Tunglu	Chekiang		29.47 x 119.37.
328	Tungngolo	Hsikang	12,050	30.4 x 101.39.
329	Tungting Lake	Hunan	low	29.10 x 112.50.

## THE REPTILES OF CHINA

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
330	Tungyung Island	Fukien		26.21 x 120.9.
*331	Two Brothers Is- lands	Chekiang		
332	Wangwanshan	Anhwei	2500	about 12 miles west of Mokanshan.
333	Wanhsien	Szechwan	600	30.50 x 108.26.
334	Wanszushan	Kwangtung	3806	near the Hunan boundary north of Shiuchow; spelled "Mahn tsi shan" by Mell, 1922, map (also see p. 4).
335	Washan	Szechwan	10,550	29.20 x 103.5.
336	Wei Ho	Shensi and Kansu		
337	Weih sien	Shantung	low	36.45 x 119.9.
338	Wenchow	Chekiang	low	28.0 x 120.37; given as Yungkia in List of Post Offices.
339	Wenchwan	Szechwan		31.21 x 103.24.
340	Western Hills	Hopei		west of Peiping; peaks to about 5000.
341	Wuan	Honan		36.44 x 114.14.
342	Wuchang	Hupei	low	30.39 x 114.23.
343	Wuchih Moun- tains	Hainan	6300	also known as Five-finger Moun- tains.
344	Wuchow	Kwangsi		23.32 x 111.26; given as Tsangwu in List of Post Offices.
345	Wuhu	Anhwei	low	31.20 x 118.23.
346	Wukang	Hunan	1181	26.45 x 110.16.
347	Wusih	Kiangsu	low	31.34 x 120.26.
348	Wusüeh	Hupei	low	29.50 x 115.41.
349	Wutaishan	Shansi		39.0 x 113.40.
350	Wutingchow	Yunnan	6000	25.30 x 102.26; given as Wuting in List of Post Offices.
351	Wuyuan	Anhwei		29.11 x 117.47.
352	Wuyung	Kwangtung	low	about 45 miles east of Canton.
353	Xieng Khouang	Laos		19.20 x 103.22.
354	Yachow	Szechwan	2500	29.59 x 103.10; given as Yaan in List of Post Offices.
355	Yalu River			between Korea and Manchuria.
356	Yalung River	Szechwan, etc.		
357	Yamala	Hsikang	12,800	29.52 x 99.54; variously given as Ramala, Ranong, etc. Lamaya in List of Post Offices.
*358	Yamangao	Hunan	197	a village near Siangsiang (27.45 x 112.28).
*359	Yaochi	Szechwan		near Muping.



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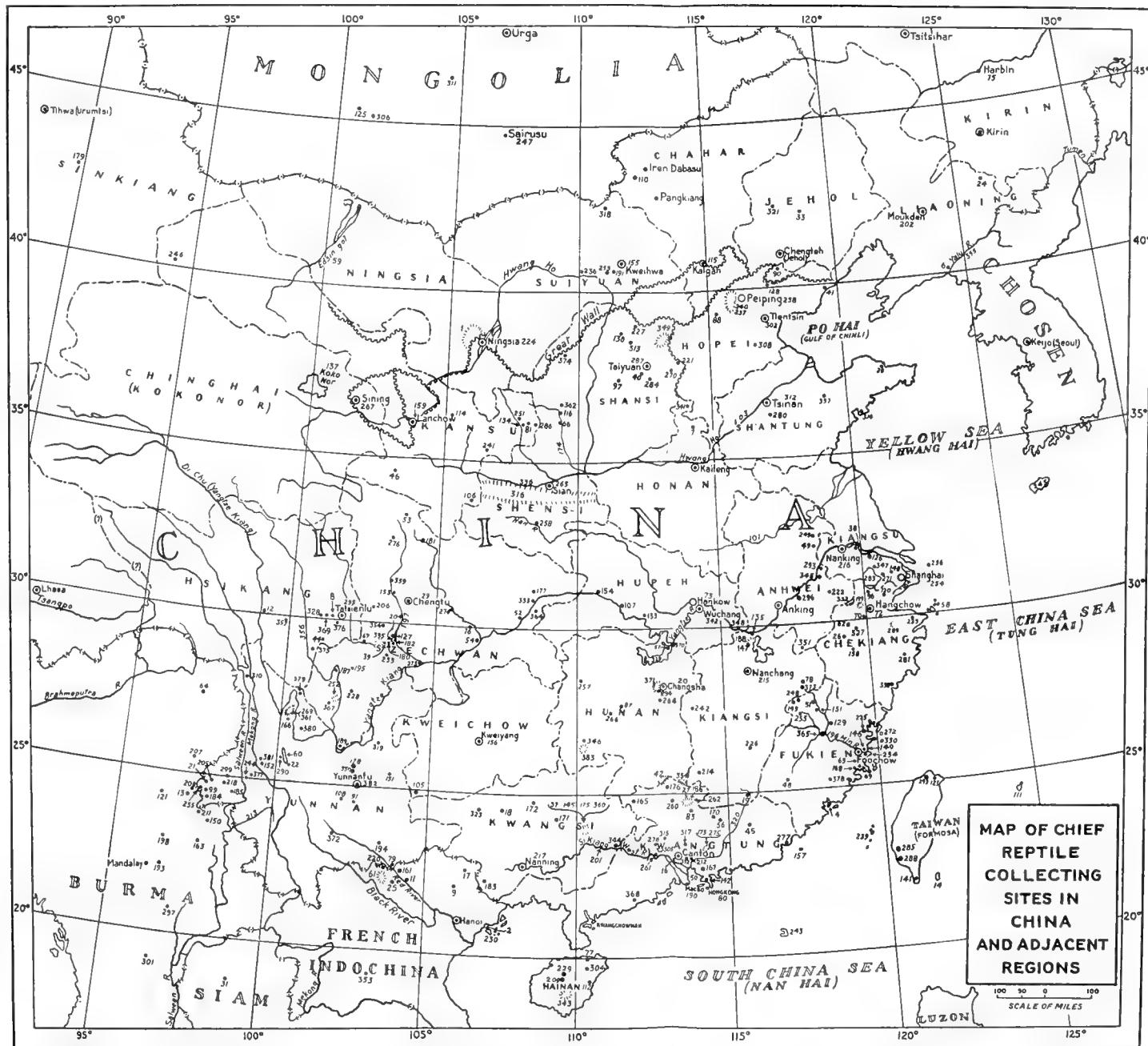


FIG. 78. Outline map showing chief reptile collecting sites in China and adjacent regions. See List of Localities for explanations.

	<i>Locality</i>	<i>Location</i>	<i>Altitude in Feet</i>	<i>Latitude and Longitude East of Greenwich, and Remarks</i>
360	Yaoshan	Kwangsi		a mountainous region of eastern Kwangsi with peaks to 9000 feet (Fan, 1931, pp. 2-3 and 13).
361	Yaoshan	Yunnan		26.59 x 100.8.
362	Yenan	Shensi	2769	36.44 x 109.25; given as Fushih in List of Post Offices.
*363	Yenchinghsi	Szechwan		in Opieh Hsien.
364	Yenchingkou	Szechwan		near Wanhhsien.
365	Yenping	Fukien	600	26.52 x 118.7; given as Nanping in List of Post Offices.
*366	Yenting	Chekiang	low	on the southeastern coast of Chekiang.
367	Yenyuan	Szechwan	8612	27.29 x 101.36.
368	Yengkong	Kwangtung	low	21.53 x 111.55.
369	Yinkuanchai	Hsikang	11,483	about 30 miles west of Tatsienlu.
370	Yochow	Hunan	low	29.20 x 113.6; given as Yoyang in List of Post Offices; also known as Chenglingfow.
371	Yohlushan	Hunan	984	28.15 x 112.55.
372	Yuankiang	Yunnan	1500	23.38 x 102.0.
373	Yuanshan	Kiangsi		28.8 x 117.42; also known as Chien-shan.
374	Yulin	Shensi	3169	38.18 x 109.20.
375	Yulunghsi	Hsikang		southwest of Tatsienlu.
376	Yulungkung	Hsikang	9842	about 7 miles south and a little west of Tatsienlu.
377	Yungchang	Yunnan	5500	25.6 x 99.10; given as Paoshan in List of Post Offices.
378	Yungchun	Fukien		25.19 x 118.14.
379	Yungning	Yunnan	5184	27.45 x 100.41.
380	Yungpeh	Yunnan	7546	26.39 x 100.44.
381	Yungping	Yunnan		25.29 x 99.32; altitude about 5300.
382	Yunnanfu	Yunnan	6400	25.2 x 102.41; given as Kunming in List of Post Offices.
383	Yunshan	Hunan	4659	about 6 miles south of Wukang.

## APPENDIX II

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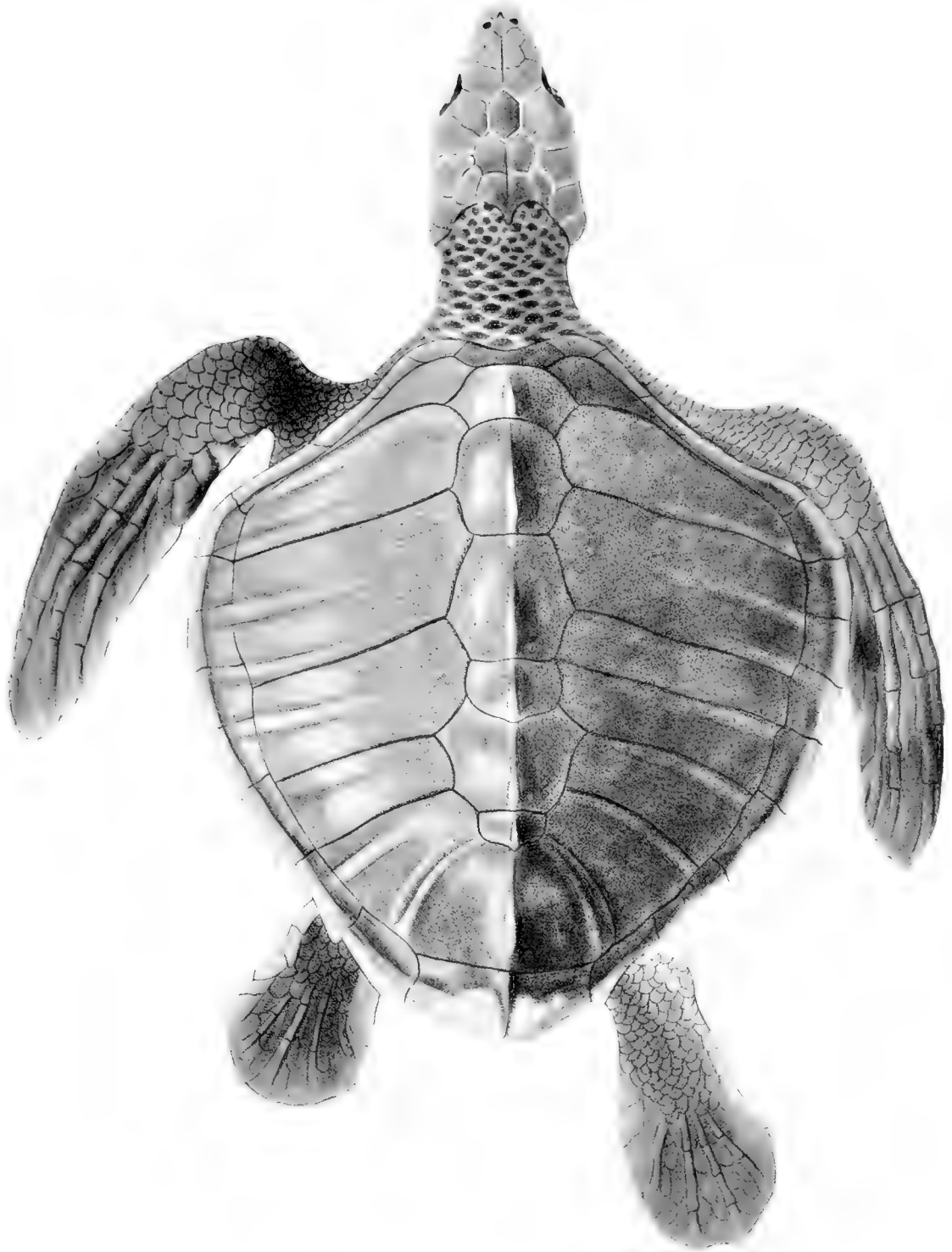
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### APPENDIX III

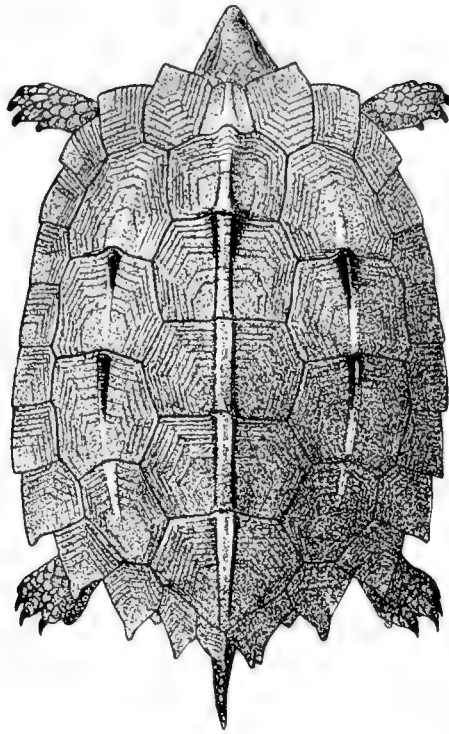
PLATES I-XXVII AND CAPTIONS



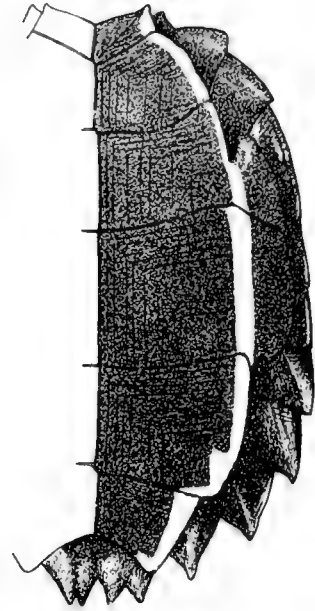




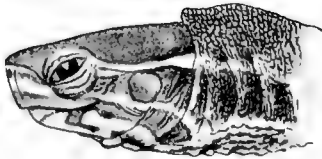
*Caretta caretta olivacea*. Cotype.  $\times \frac{1}{2}$ . (From Eschscholtz.)



A



B



C

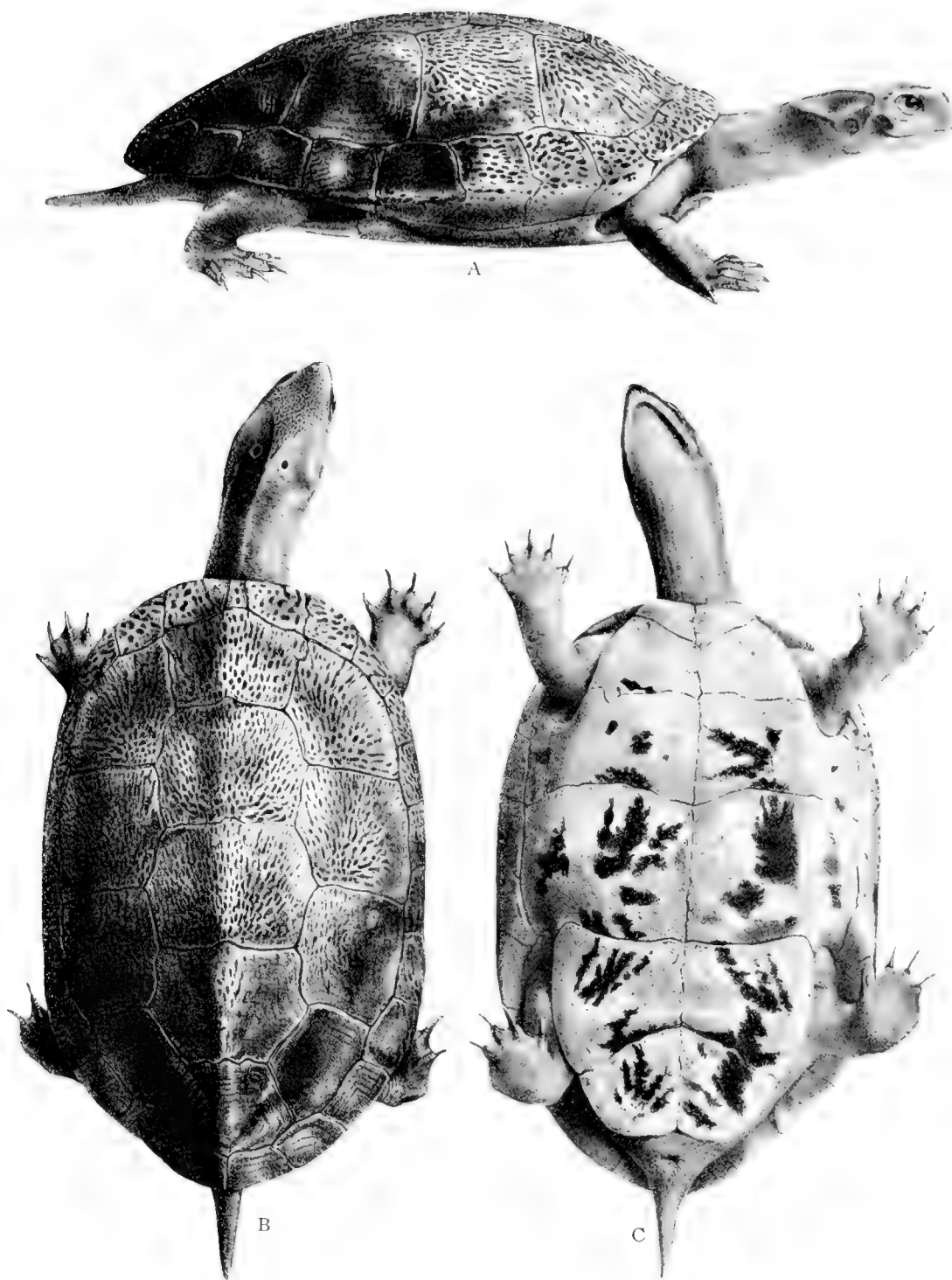


D

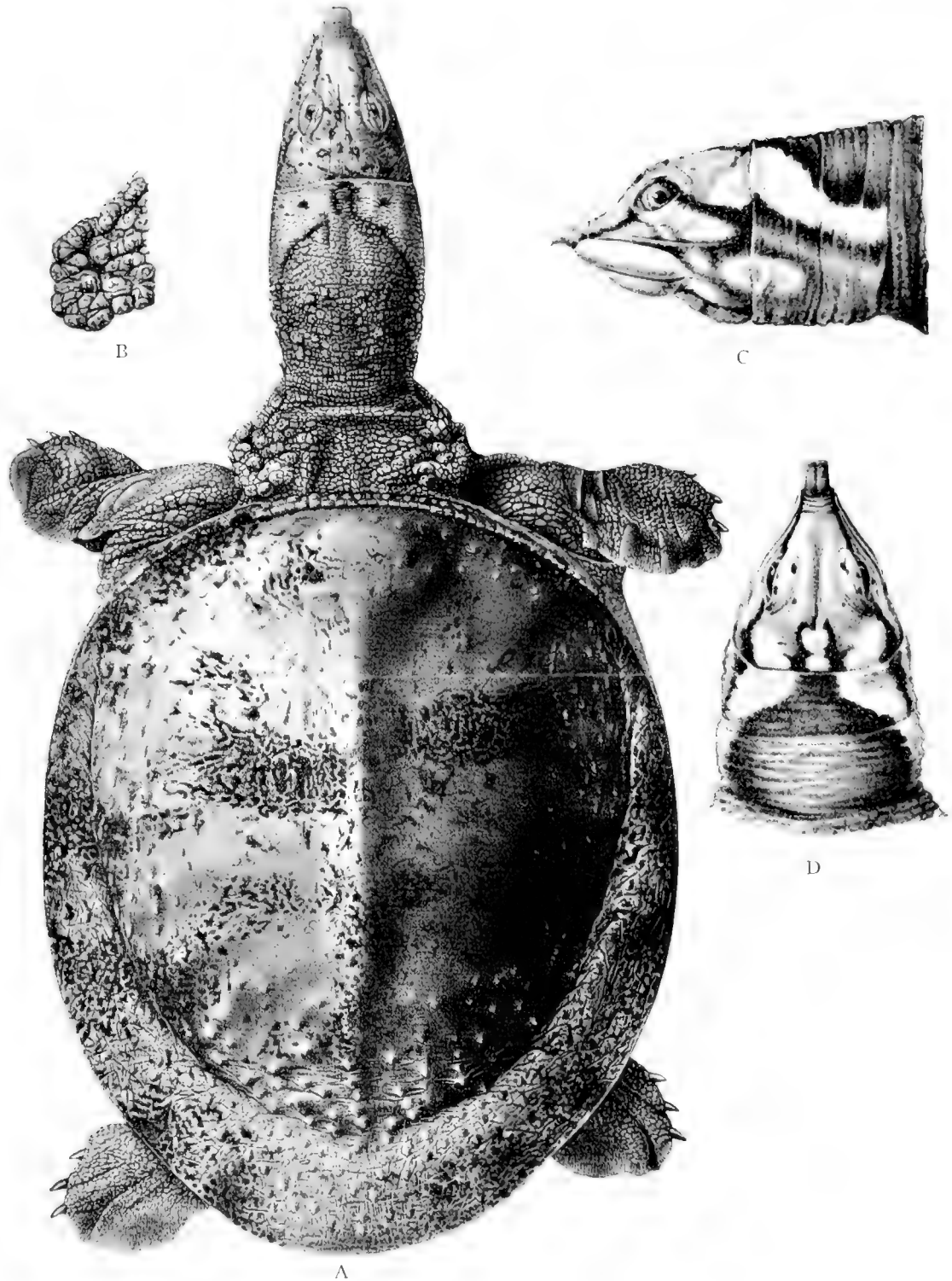
*Geoemyda spengleri spengleri*. A. Dorsal view. B. Ventral view, incomplete. (From de Rooij.)

*Cyclemys yunnanensis*. Cotype. C. Lateral view of head. (From Smith.)

Skull of *Amyda sinensis*. Natural size. D. Dorsal view. Specimen from Amur River. (From Strauch.)

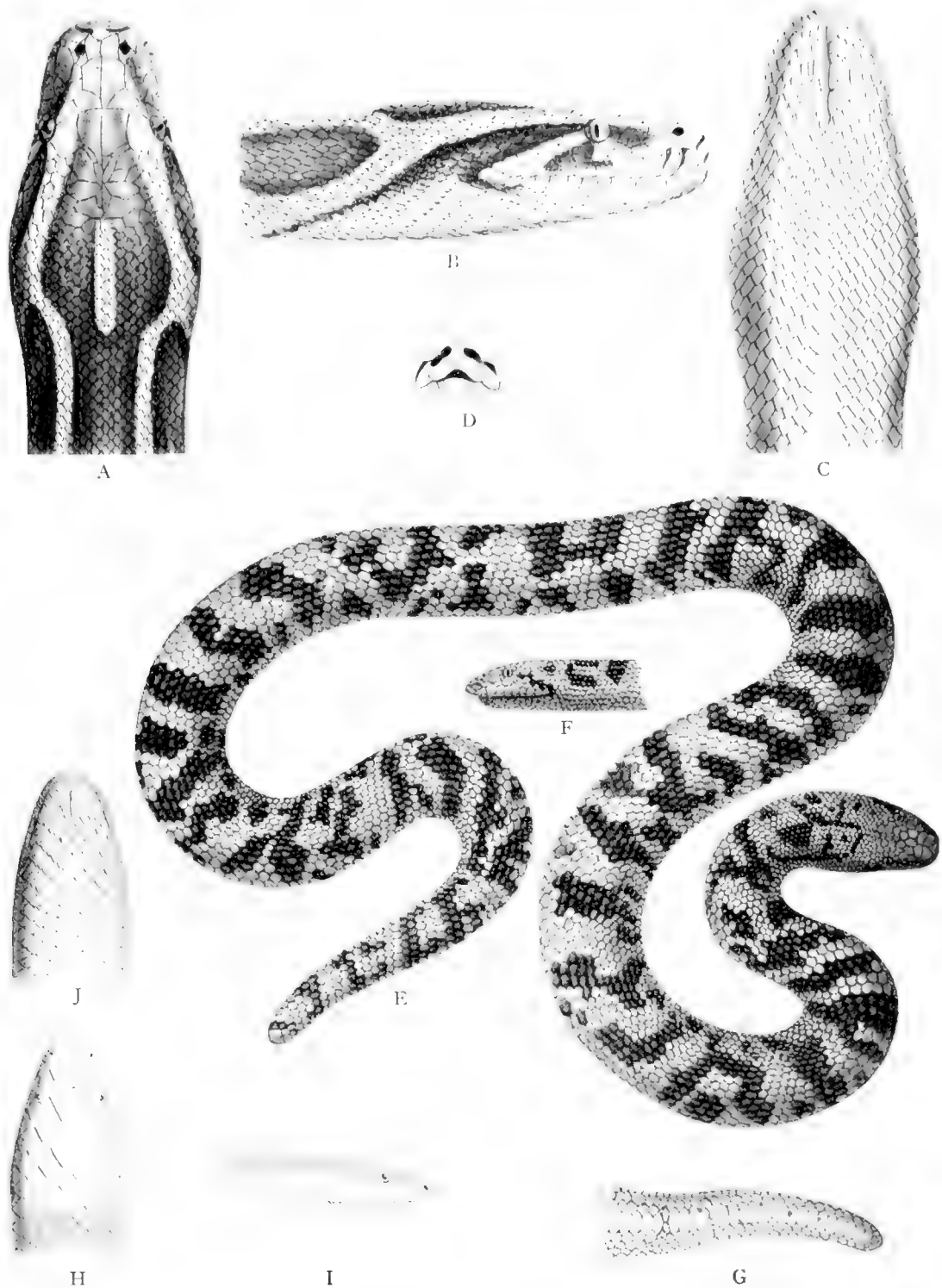


*Clemmys bealei*. Cotype.  $\times \frac{1\frac{3}{4}}{10}$ . A. Lateral view. B. Dorsal view. C. Ventral view. (From Gray.)



*Amyda steindachneri*. A. Entire specimen, x  $\frac{3}{4}$ . B. Group of tubercles on neck, x  $1\frac{1}{8}$ . Specimen from Kwangtung or Kwangsi. (From Siebenrock.)

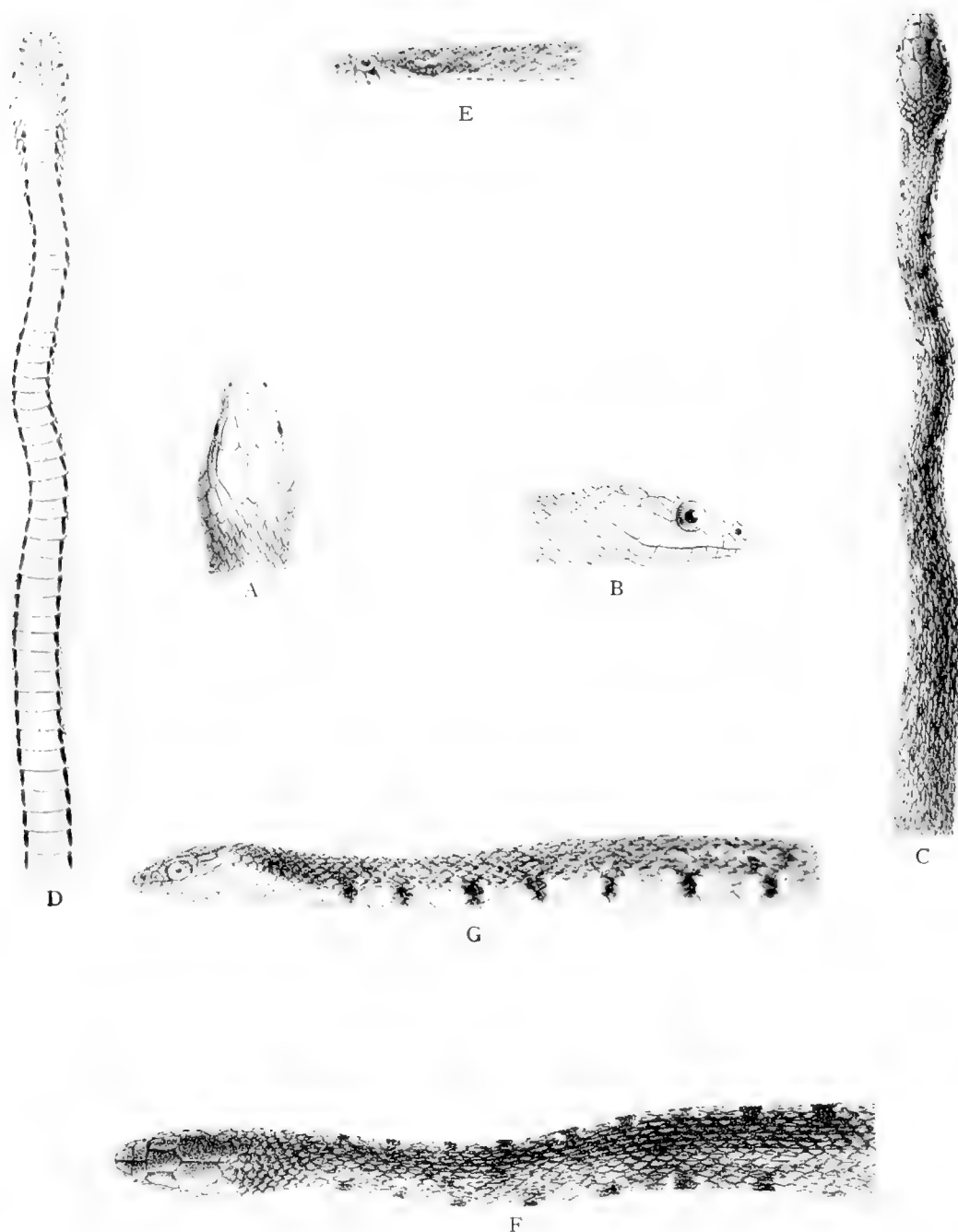
*Amyda steindachneri*. Type, x 2. C. Lateral view of head. D. Dorsal view of head. (From Siebenrock.)



*Python molurus bivittatus*. A. Dorsal view of head. B. Lateral view of head. C. Ventral view of head. D. Anterior view of snout. (From Schlegel.)

*Eryx miliaris roborowskii*. Cotype from Lukchun, Sinkiang. E. Dorsal view of entire specimen. F. Lateral view of head. G. Ventral view of tail. (From Bedriaga.)

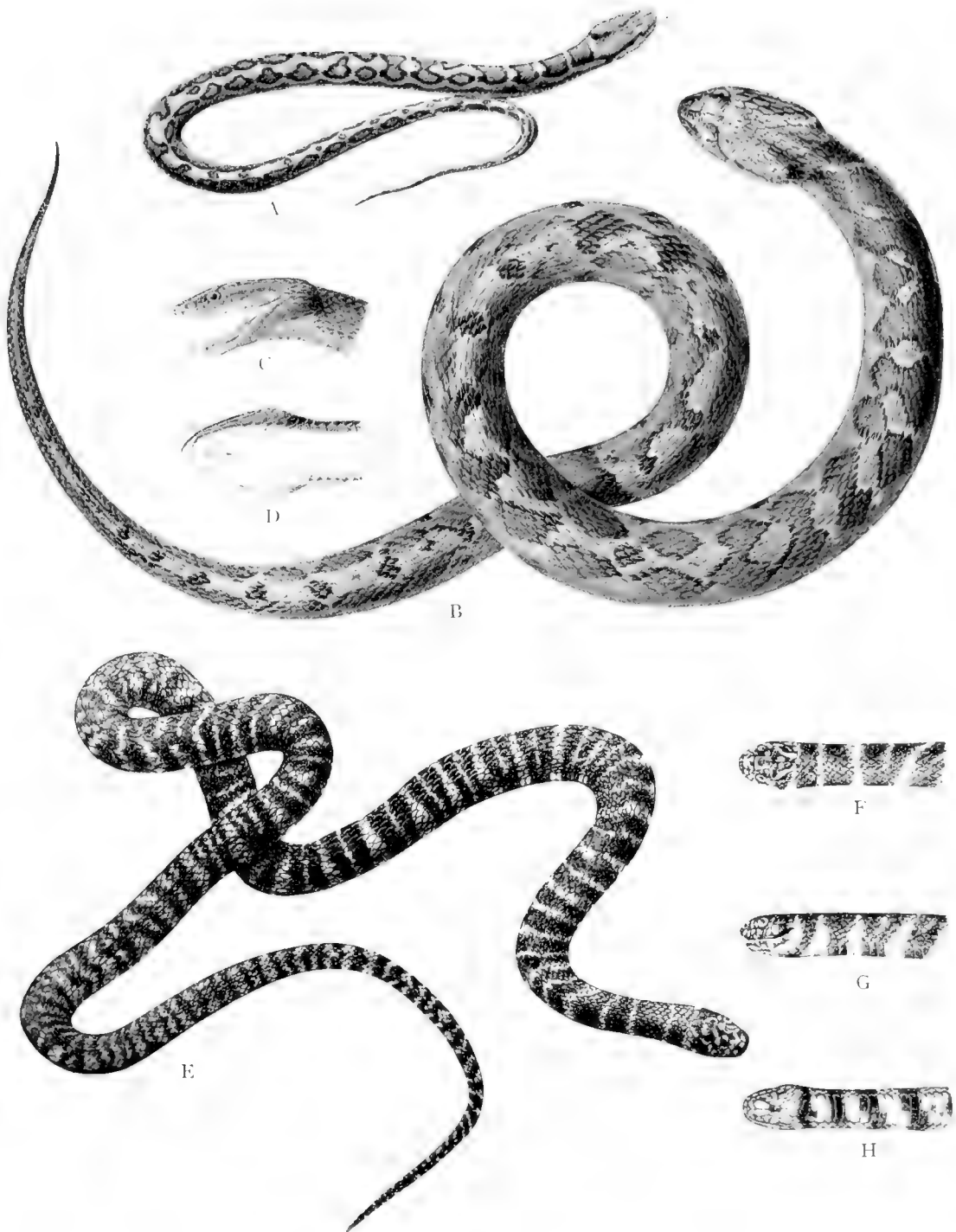
*Xenopeltis unicolor*. H. Dorsal view of head. I. Lateral view of head. J. Ventral view of head. (From Schlegel.)



*Natrrix chrysarga*. A. Dorsal view of head. B. Lateral view of head. (From Schlegel.)

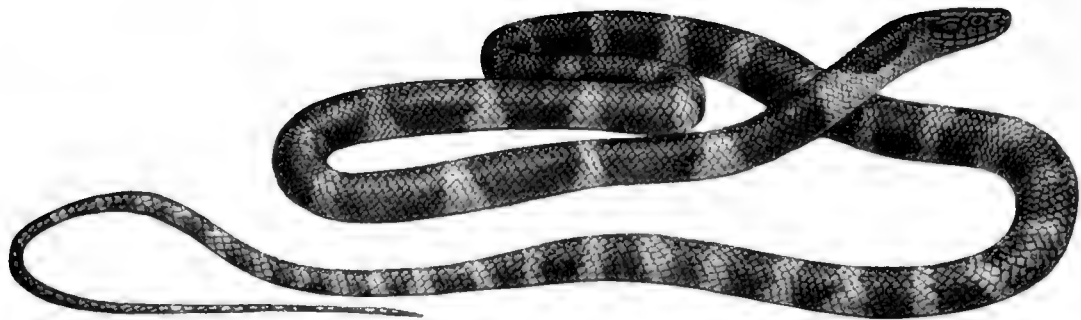
*Natrrix craspedogaster*. Cotype. Natural size. C. Dorsal view of head and forebody. D. Ventral view of head and forebody. E. Lateral view of head and neck. (From Boulenger.)

*Natrrix percarinata*. Type. Natural size. F. Dorsal view of head and forebody. G. Lateral view of head and forebody. (From Boulenger.)



*Macropisthodon rudis*.  $\times \frac{2}{3}$ . A. Juvenile, entire specimen. B. Adult, entire specimen. C. Lateral view of head of adult. D. Ventral view of head of adult. Specimen from Formosa. (From Steindachner.)

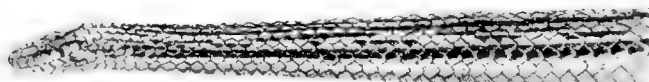
*Opisthotropis balteata*. E. Entire specimen. F. Dorsal view of head and neck. G. Lateral view of head and neck. H. Ventral view of head and neck. Specimen from French Indo-China. (From Steindachner.)



A



B



C



D



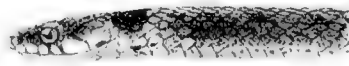
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F



G



H



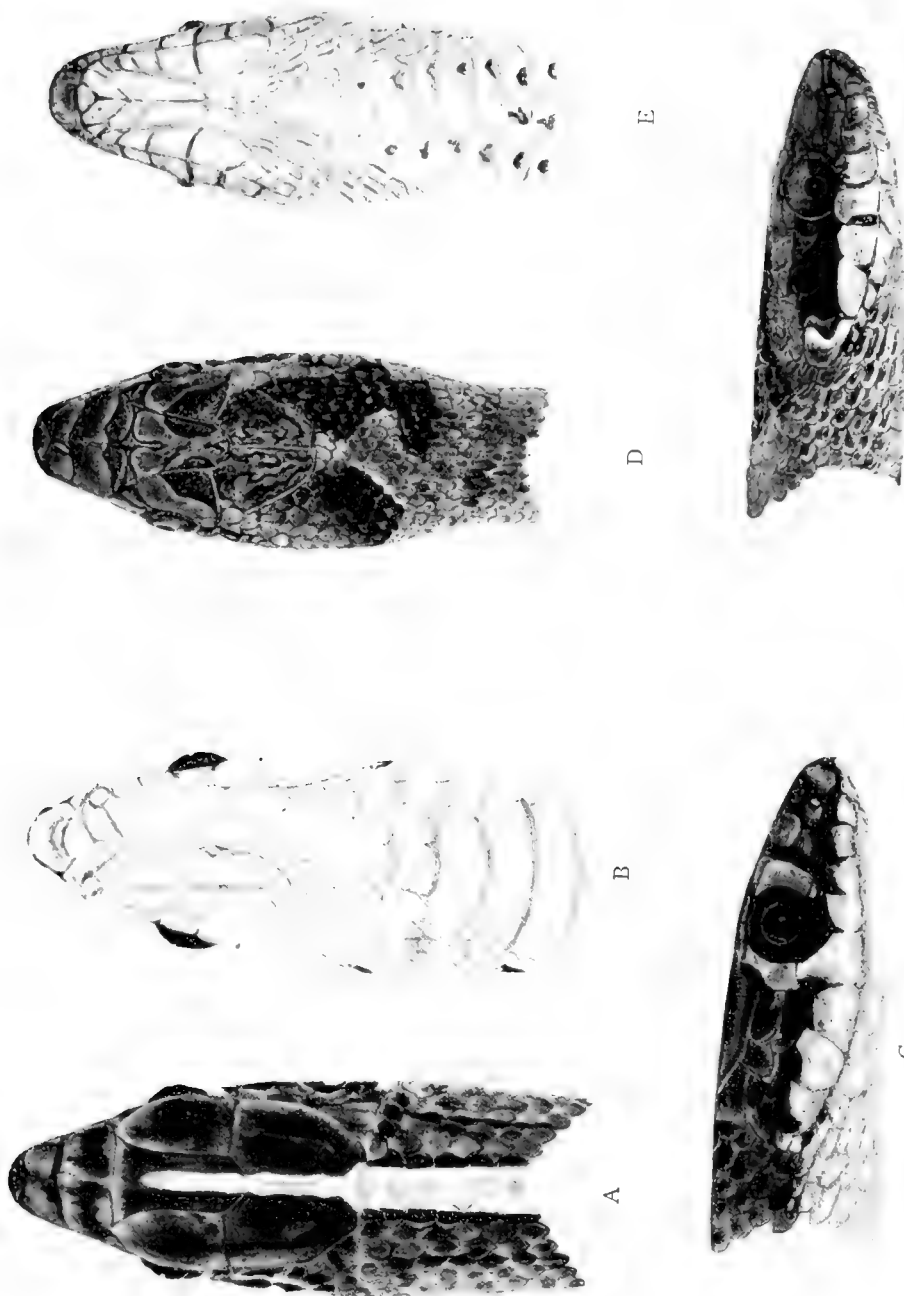
I

*Lycodon fasciatus*. Type. Natural size. A. Entire specimen. (From Anderson.)

*Opisthotropis latouchii*. Type. B. Dorsal view of head and forebody, natural size. C. Lateral view of head and forebody, natural size. D. Dorsal view of head, enlarged. E. Lateral view of head, enlarged. F. Ventral view of head, enlarged. (From Boulenger.)

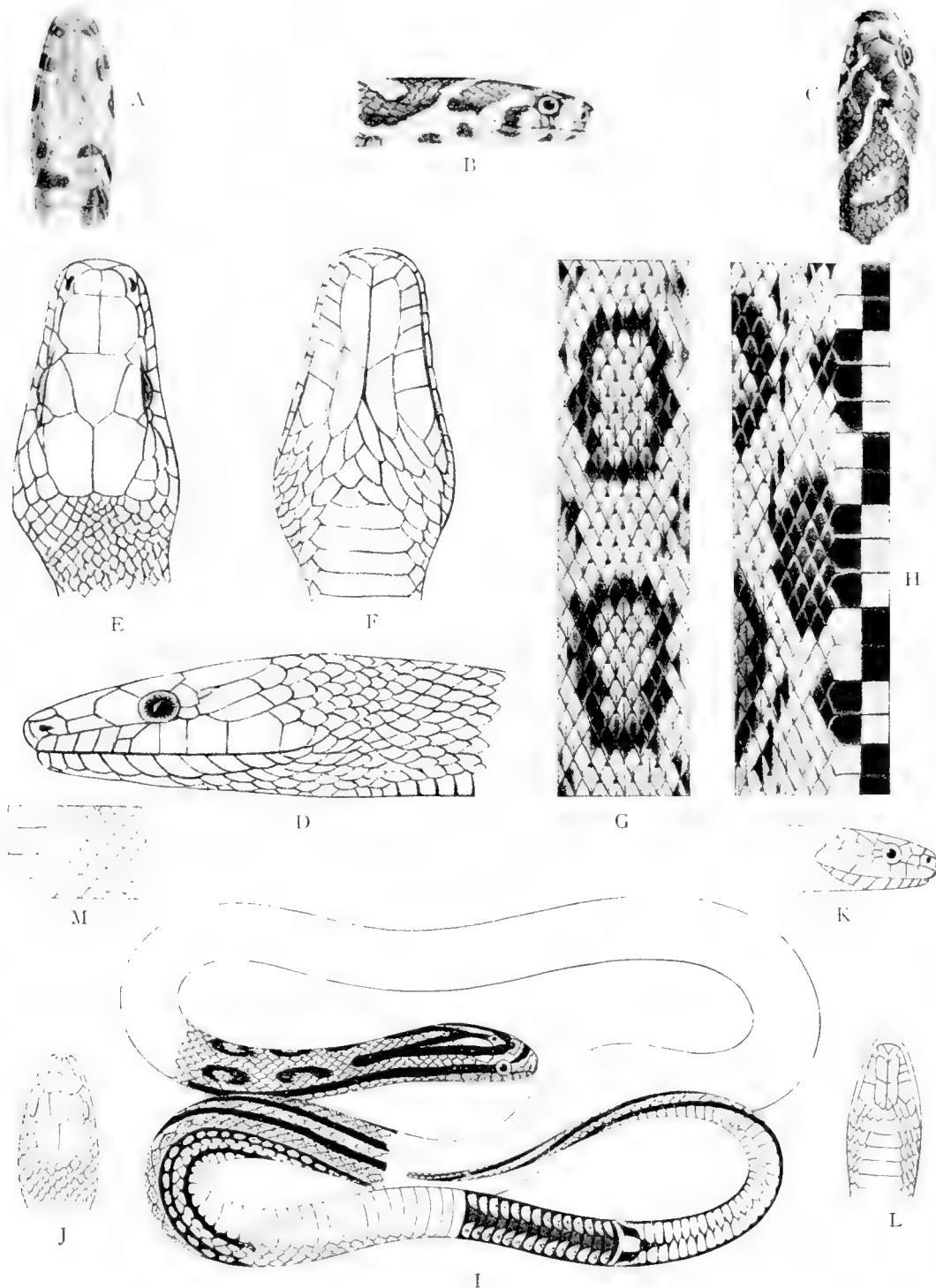
*Trirhinopholis styani*. Cotype. Natural size. G. Dorsal view of head and forebody. H. Lateral view of head. I. Chin. (From Boulenger.)





*Coluber spinalis*, x 4. A. Dorsal view of head. B. Ventral view of head. C. Lateral view of head. A.M.N.H. No. 28257 from Chintzu, Shansi.

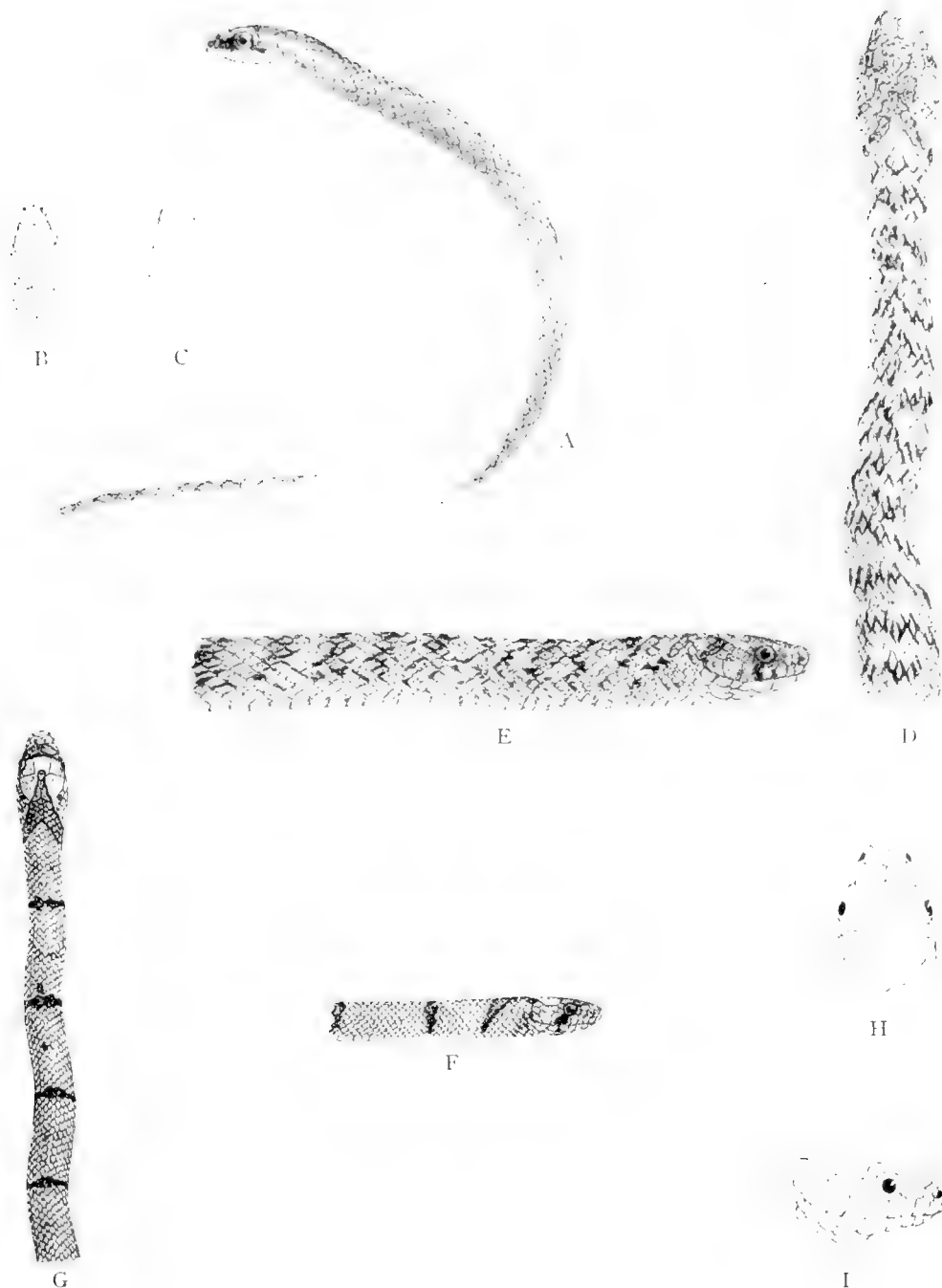
*Elaphe dioue*, x 2. D. Dorsal view of head. E. Ventral view of head. F. Lateral view of head. A.M.N.H. No. 28258 from Maitaichao, Suiyuan.



*Elaphe mandarinus*. Type. A. Ventral view of head. B. Lateral view of head. C. Dorsal view of head. (From Guenther.)

*Elaphe moellendorffi*. Cotype. D. Lateral view of head. E. Dorsal view of head. F. Ventral view of head. G. Pattern of body, dorsal view. H. Pattern of body, lateral view. (From Boettger.)

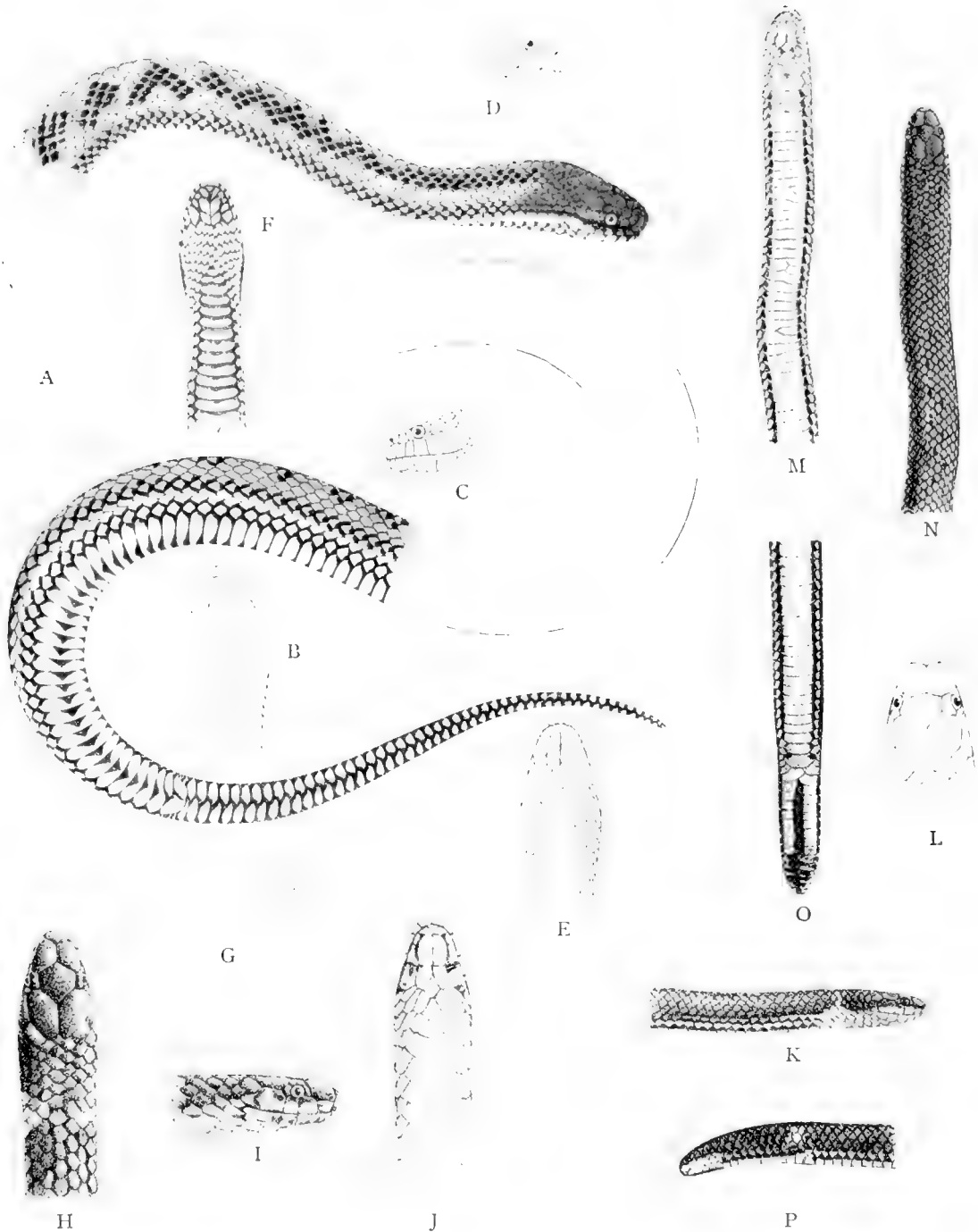
*Elaphe rufodorsata*. I. Entire specimen. J. Dorsal view of head. K. Lateral view of head. L. Ventral view of head. M. Scales at midbody. Specimen from China. (From Jan and Sordelli.)



*Eurypholis doriae*. Cotype.  $\times 34$ . A. Head and forebody. B. Dorsal view of head. C. Ventral view of head. (From Boulenger.)

*Holarchus formosanus*. Type. Natural size. D. Dorsal view of head and forebody. E. Lateral view of head and forebody. (From Boulenger.)

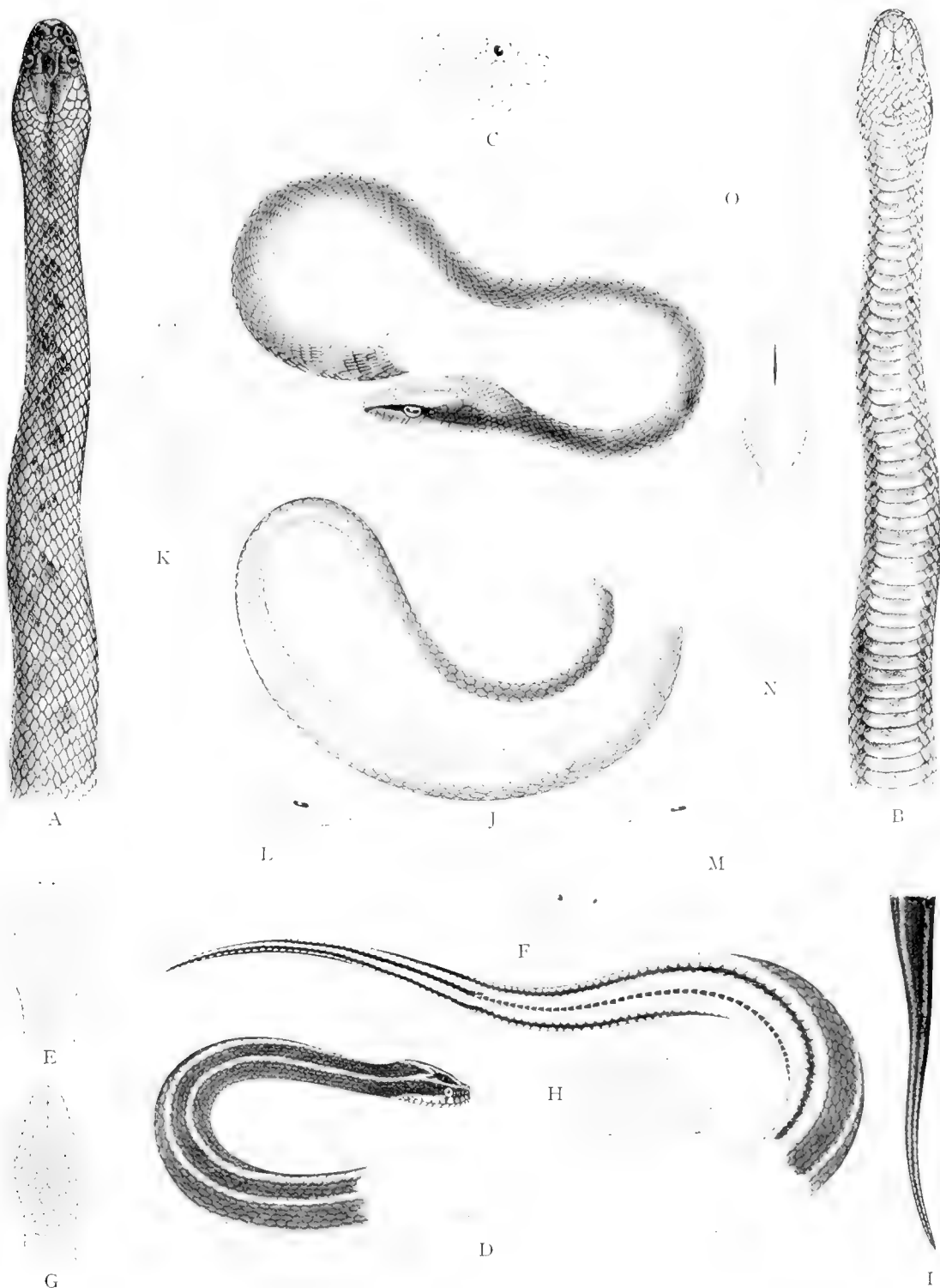
*Holarchus chinensis*. Type. F. Lateral view of head and neck, natural size. G. Dorsal view of head and forebody, natural size. H. Dorsal view of head, enlarged. I. Lateral view of head, enlarged. (From Boulenger.)



*Enhydris bennettii*. A. Entire specimen. B. Dorsal view of head. C and D. Lateral views of head. E. Ventral view of head. F. Ventral view of head and neck, showing pattern. G. Scales at midbody. Specimen from China. (From Jan and Sordelli.)

*Calamaria pavimentata* *pavimentata*. x 2. H. Dorsal view of head. I. Lateral view of head. J. Ventral view of head. Specimen from Lungan, Szechwan. (From Guenther.)

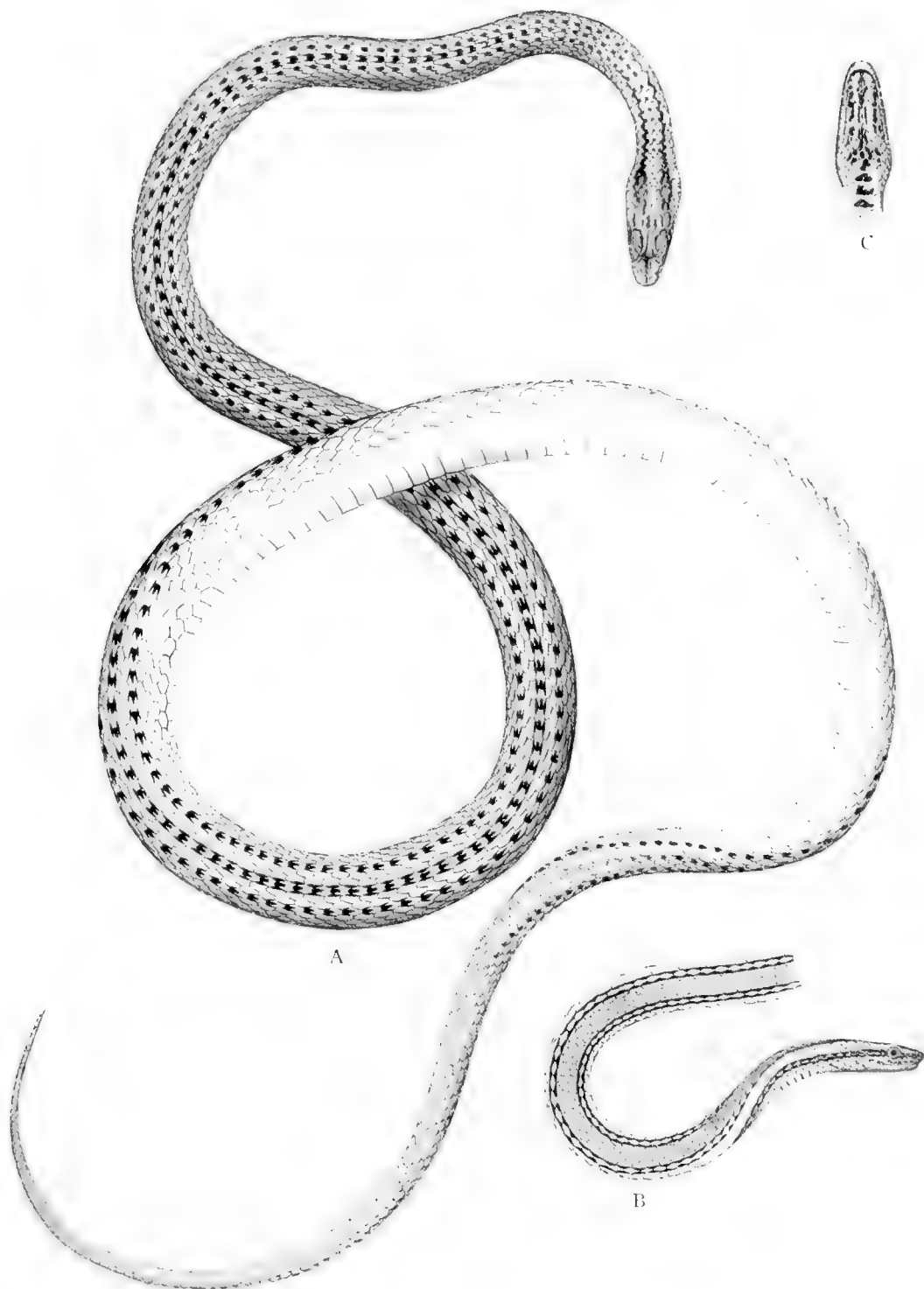
*Calamaria septentrionalis*. Cotype. K. Lateral view of head and neck. L. Dorsal view of head. M. Ventral view of head and forebody. N. Dorsal view of head and forebody. O. Ventral view of tail and posterior body. P. Lateral view of tail and posterior body. (L enlarged, others natural size.) (From Boulenger.)



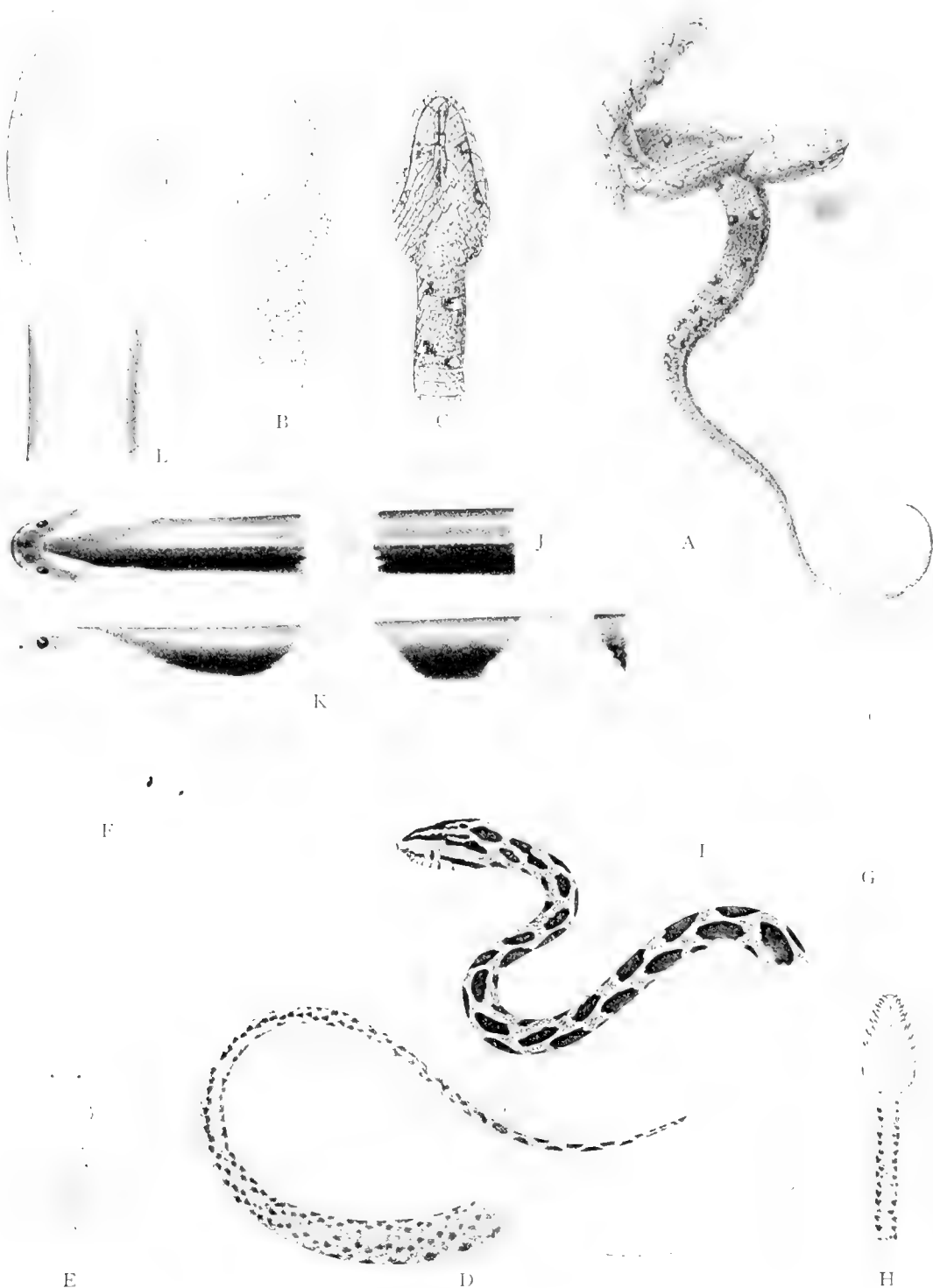
*Enhydris chinensis*. Type. A. Dorsal view of head and forebody, natural size. B. Ventral view of head and forebody, natural size. C. Lateral view of head,  $\times 1\frac{1}{2}$ . (From Boulenger.)

*Enhydris enhydris*. D. Entire specimen. E. Dorsal view of head. F. Lateral view of head. G. Ventral view of head. H. Scales at midbody. I. Dorsal view of tail, showing pattern. Specimen from Java. (From Jan and Sordelli.)

*Ahatulla prasina*. J. Entire specimen. K. Dorsal view of head. L and M. Lateral views of head. N. Ventral view of head and neck, showing pattern. O. Scales at midbody. (From Jan and Sordelli.)



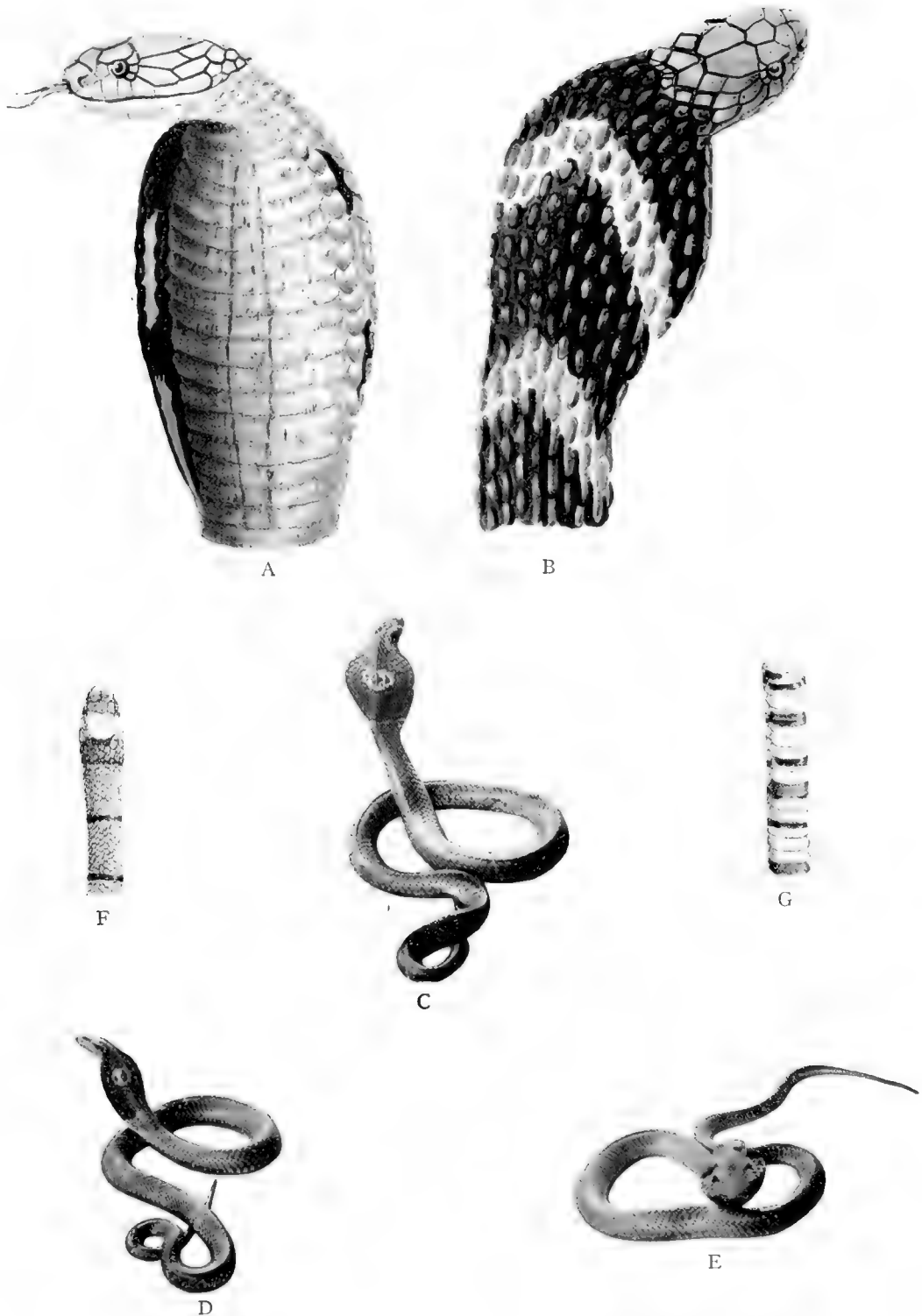
*Taphrometopon lineolatum*.  $\times 34$ . A. Entire specimen. B. Head and forebody. C. Ventral view of head. (From Strauch.)



*Psammodynastes pulverulentus*. A. Entire specimen, approximately  $\times \frac{1}{6}$ . B. Dorsal view of head and neck, natural size. C. Ventral view of head and neck, showing pattern, natural size. Specimen from Philippine Islands. (From Mocquard.)

*Boiga multomaculata*. D. Entire specimen. E. Dorsal view of head. F. Lateral view of head. G. Ventral view of head. H. Ventral view of head and neck, showing pattern. I. Scales at midbody. Specimen from Hongkong. (From Jan and Sordelli.)

*Bungarus fasciatus*. J. Dorsal view of head and forebody,  $\times \frac{1}{2}$ . K. Lateral view of head and forebody,  $\times \frac{1}{2}$ . L. Ventral view of head, natural size. Specimen from India. (From Wall.)

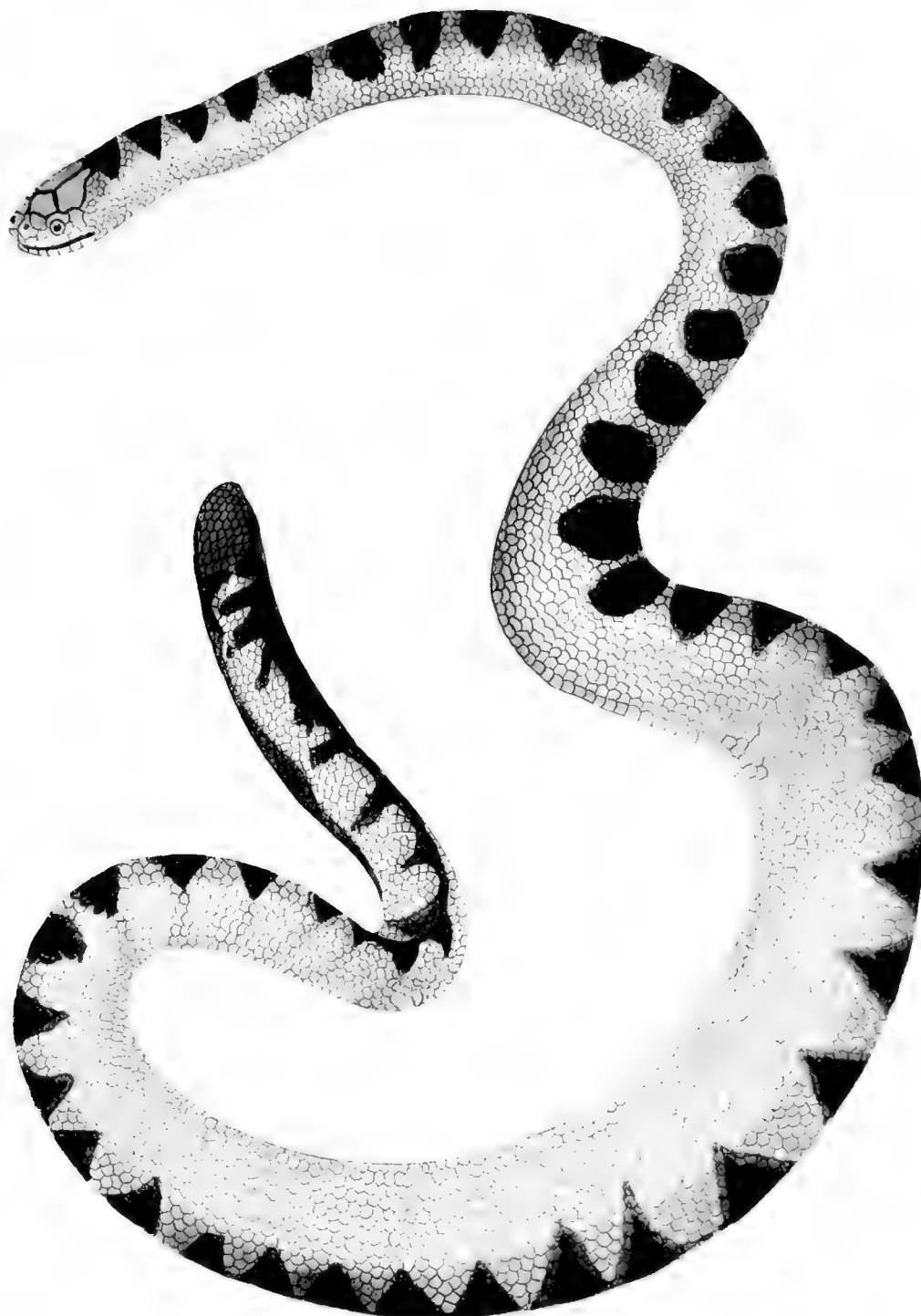


*Naja hannah*. Cotype. A. Ventral view of head and neck with hood fully expanded. B. Dorsal view with hood partly expanded. (From Cantor.)

*Naja naja atra*. C, D and E. Specimen from Nodoo, Hainan.

*Calliophis maccllelandi*. F. Dorsal view of head and neck. G. Ventral view of section of body. Specimen from China. (From Guenther.)

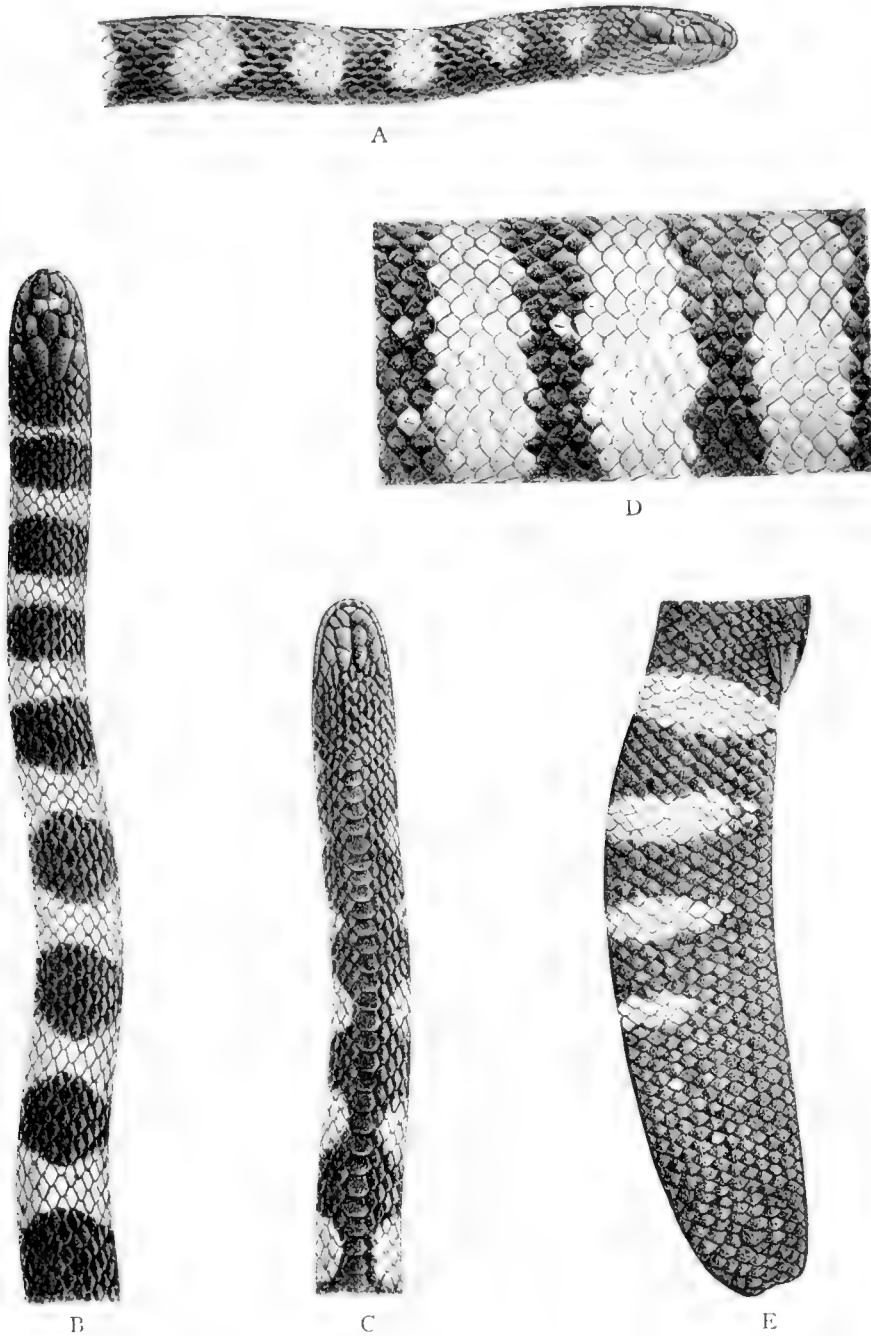




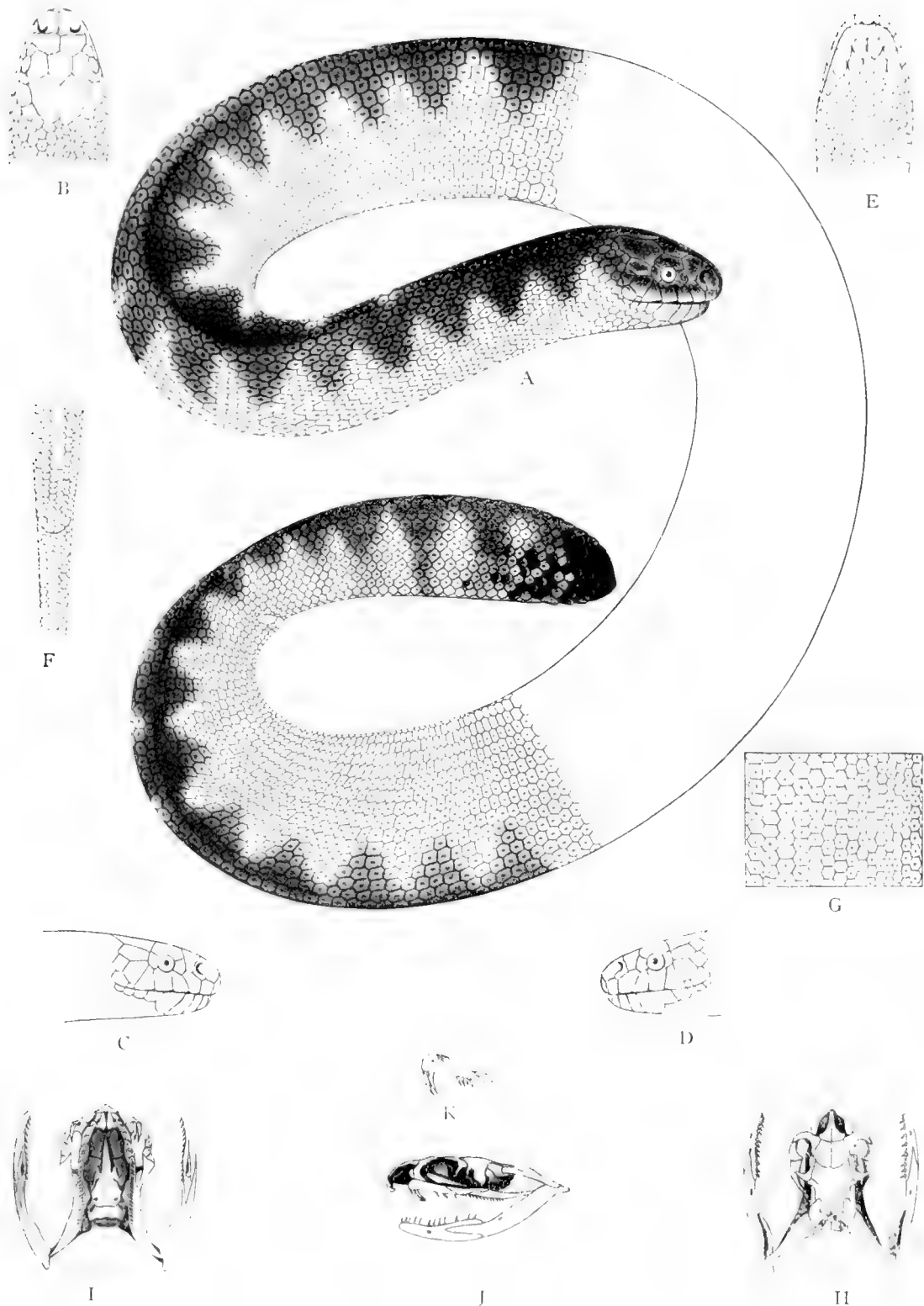
*Thalassophina viperina*. Type.  $\times \frac{1}{10}$ . (From Schmidt.)



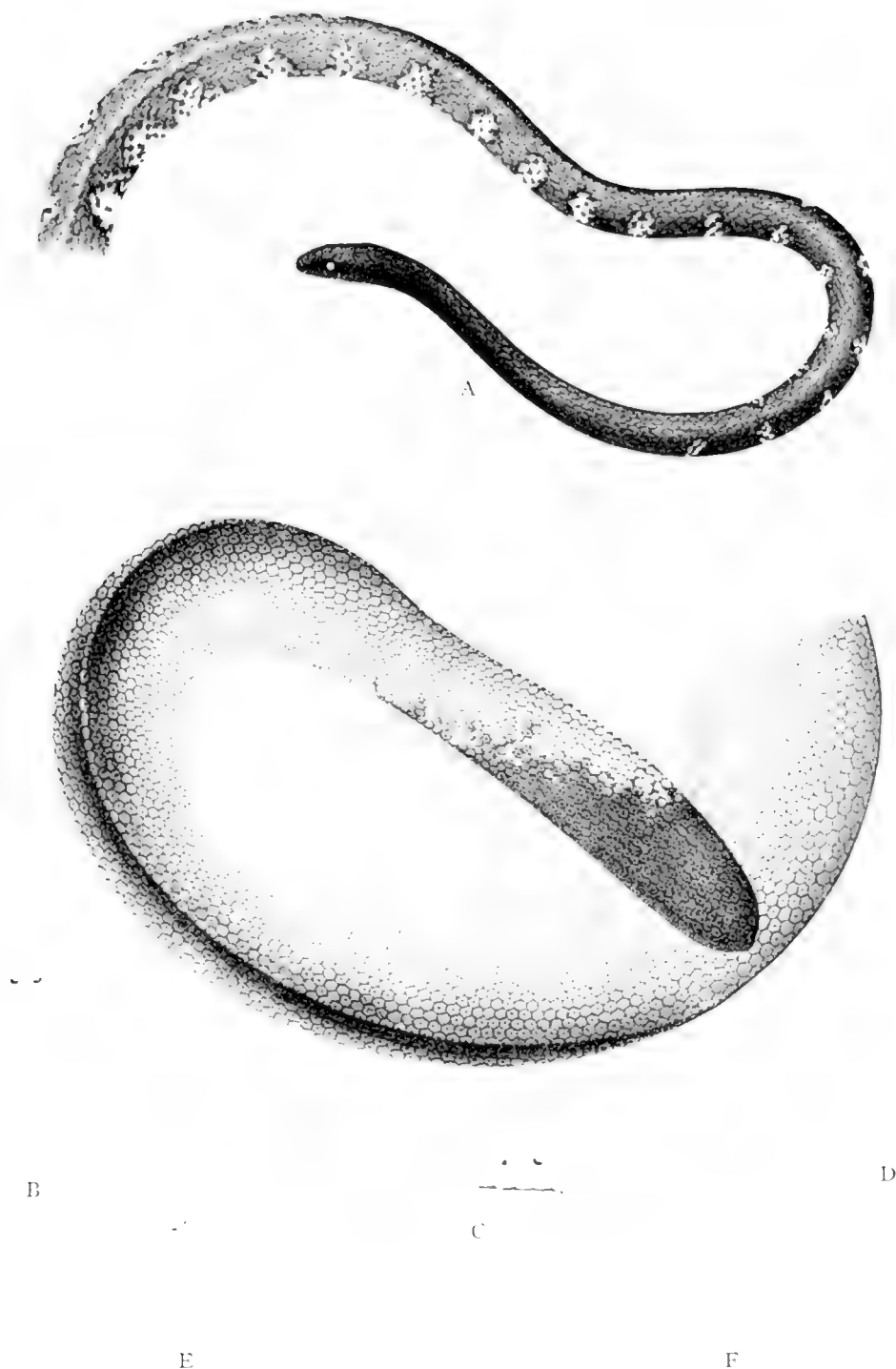
*Hydrophis carulescens*. A. Entire specimen. B. Dorsal view of head. C and D. Lateral views of head. E. Ventral view of head. F. Scales at midbody. G. Ventral view of cloacal region. H. Lateral view of maxillary bone. (From Jan and Sordelli.)



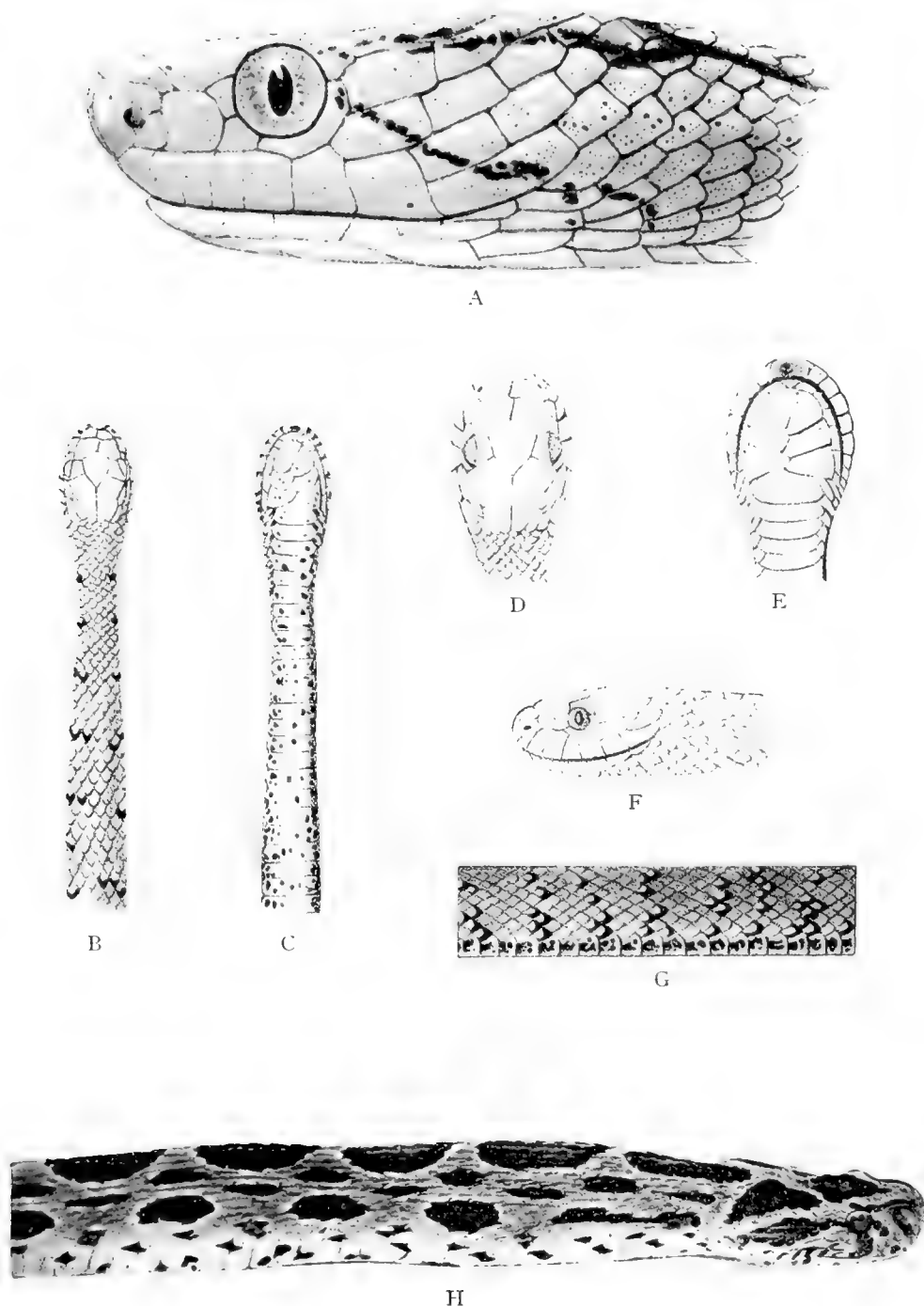
*Hydrophis melanocephalus*. Type. Natural size. A. Lateral view of head and forebody. B. Dorsal view of head and forebody. C. Ventral view of head and forebody. D. Lateral view at midbody. E. Lateral view of tail. (From Boulenger.)



*Lapemis hardwickii*. A. Entire specimen. B. Dorsal view of head. C and D. Lateral views of head. E. Ventral view of head. F. Ventral view of cloacal region. G. Scales at midbody. H. Dorsal view of skull. I. Ventral view of skull. J. Lateral view of skull. K. Lateral view of maxillary bone. (From Jan and Sordelli.)



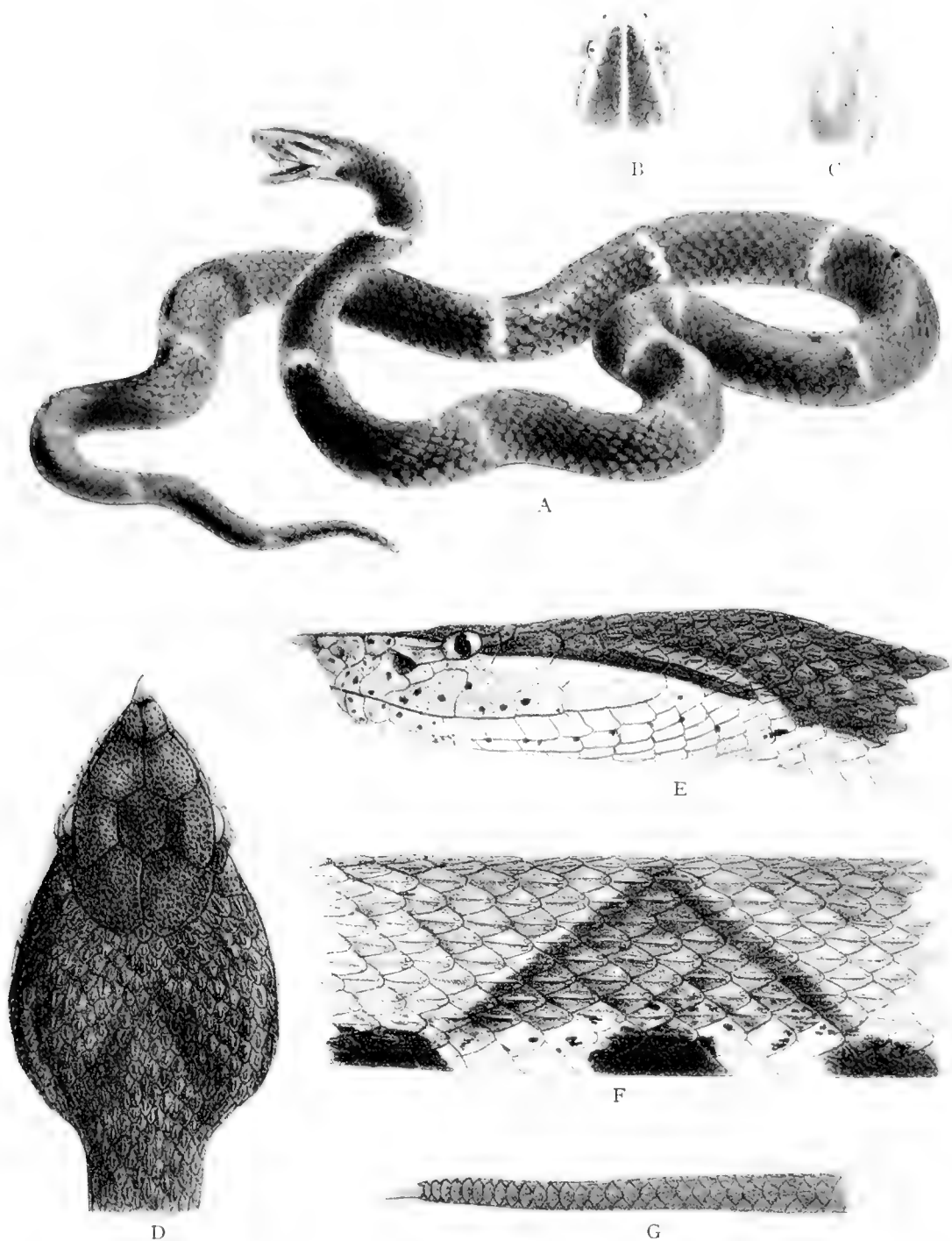
*Microcephalophis gracilis gracilis*. A. Entire specimen. B. Dorsal view of head. C. Lateral view of head. D. Ventral view of head. E. Ventral view of cloacal region. F. Scales at midbody. Specimen from Malabar Coast. (From Jan and Sordelli.)



*Amblycephalus chinensis*. Type. A. Lateral view of head. (From Barbour.)

*Amblycephalus moellendorffi*. B. Dorsal view of head and forebody. C. Ventral view of head and forebody. D. Dorsal view of head. E. Ventral view of head. F. Lateral view of head. G. Pattern of body, lateral view. (From Boettger.)

*Vipera russelii siamensis*. Type. H. Lateral view of head and forebody. (From Smith.)

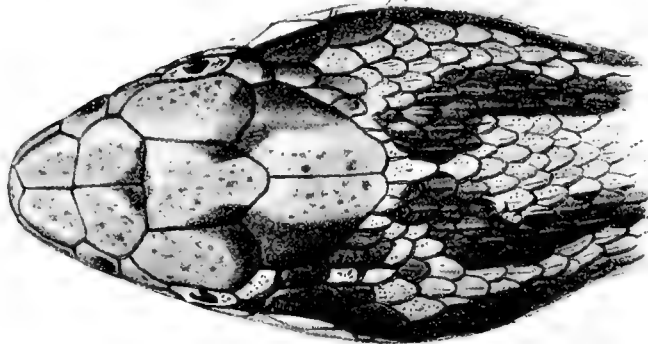


*Azemiops feae*. Type. A. Entire specimen, x  $\frac{3}{4}$ . B. Dorsal view of head. C. Ventral view of head. (From Boulenger.)

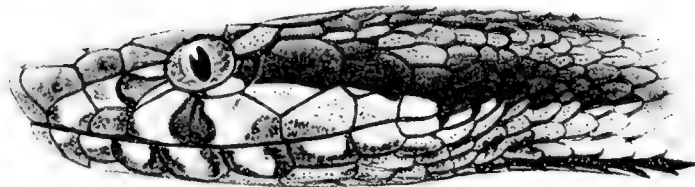
*Agkistrodon acutus*. Cotype. D. Dorsal view of head. E. Lateral view of head (rostral appendage is distinctly upturned in life). F. Lateral view of section of body. G. Lateral view of end of tail. (From Guenther.)



A



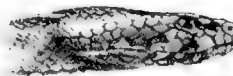
B



C



D



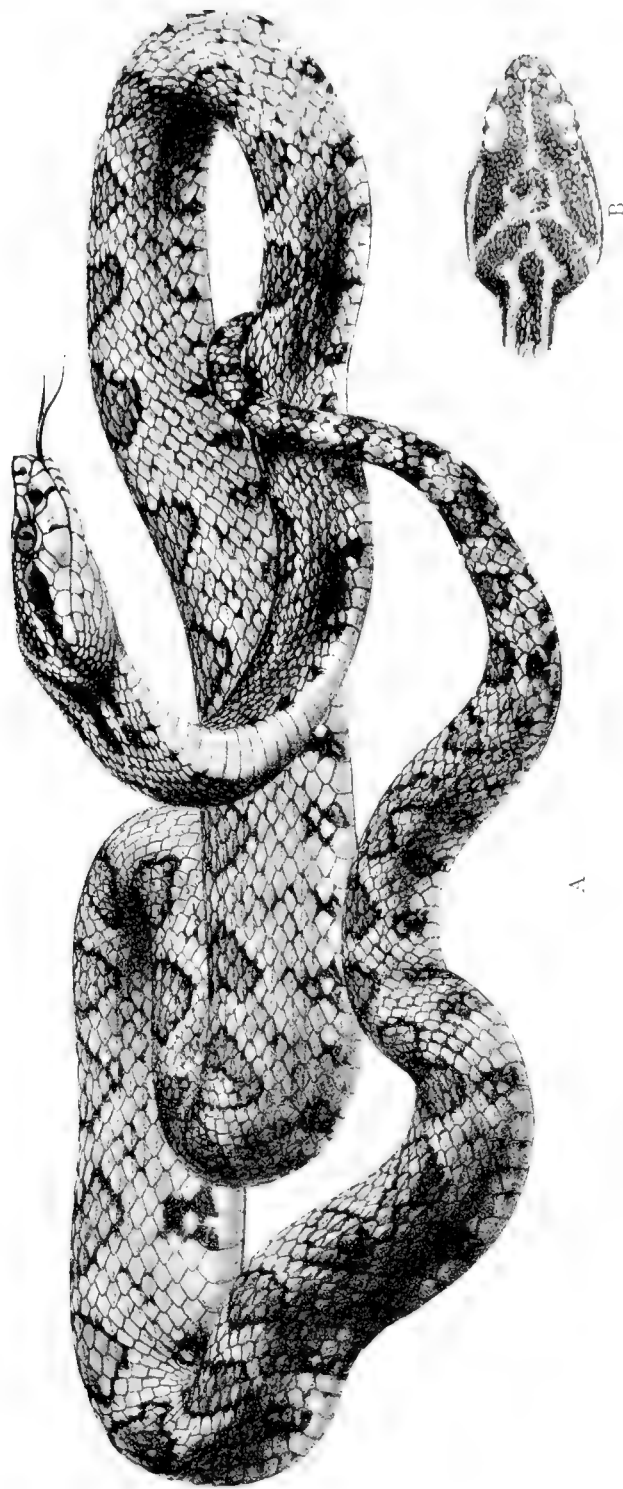
E

*Agkistrodon halys*. A. Lateral view of head. Specimen from Hupeh. (From Barbour.)

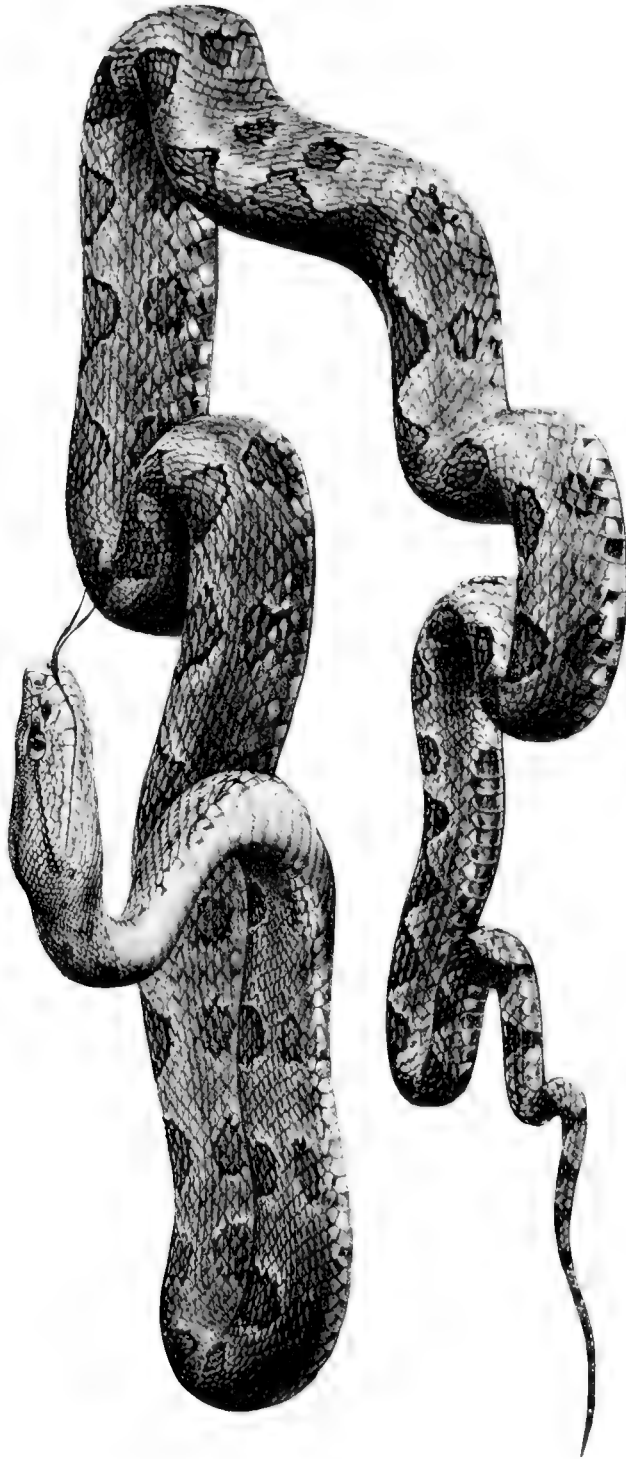
*Agkistrodon strauschi*. B. Dorsal view of head. C. Lateral view of head. M.C.Z. No. 7327 from Yamala Pass, Hsikang. (From Barbour.)

*Trimeresurus monticola*. Cotype. D. Dorsal view of head. E. Lateral view of head. (From Guenther.)





*Trimersurus jerdonii*. Cotype. A. Entire specimen. B. Dorsal view of head. (From Guenther.)



*Trimeresurus microsquamatus*. Specimen from Formosa. (From Swinhoe.)



A



B

A. *Trimeresurus monticola* and eggs as found in a pile of bamboo waste at Kuatun, Fukien. Photographed August 16, 1926.

B. Eggs of *Elaphe carinata* as found in a pile of bamboo waste, Kuatun, Fukien, July 29, 1926.



APPENDIX IV  
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